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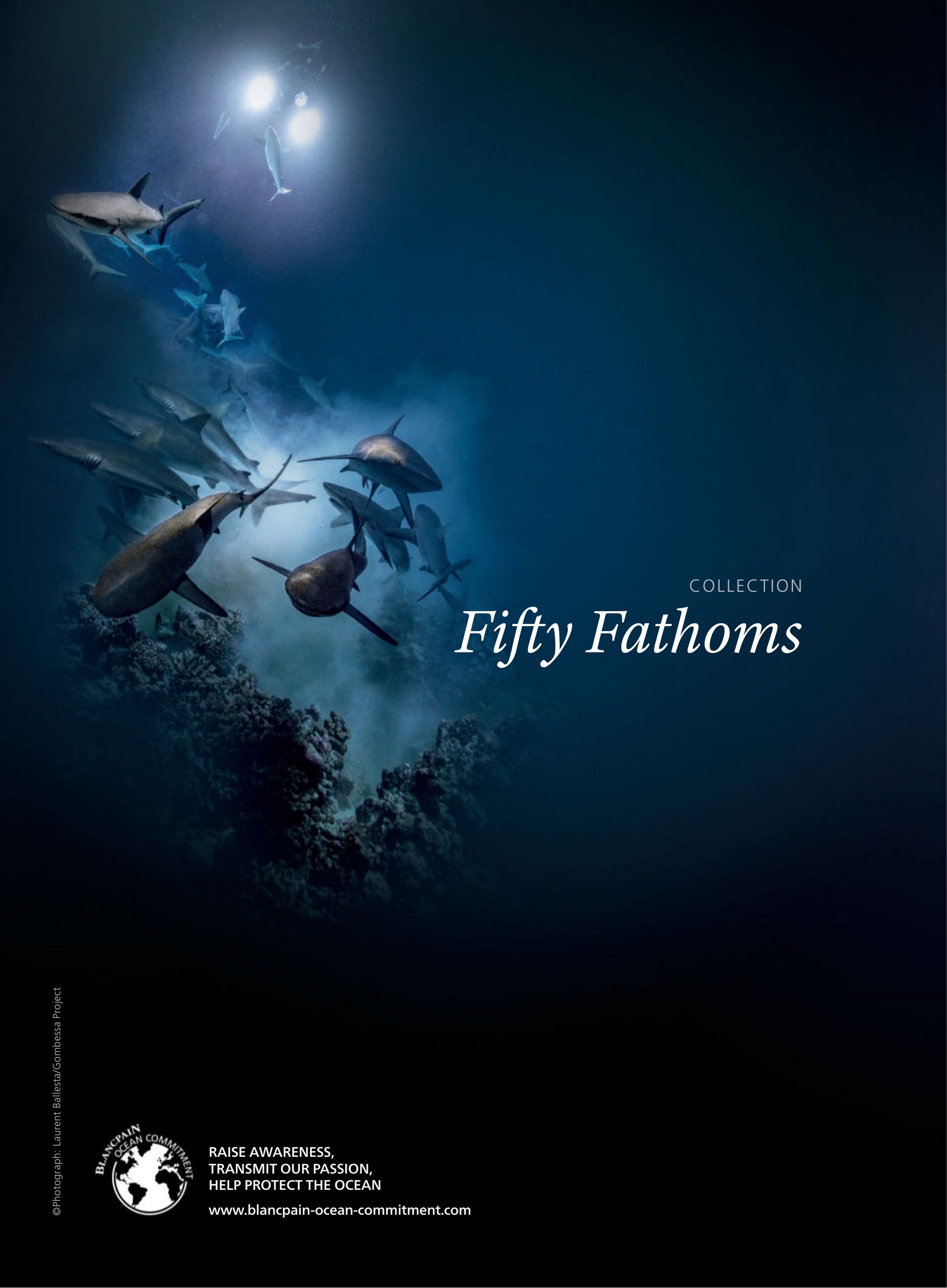
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Building Responsible Partnerships



MEETING THE MUSIC MAN

Christopher Hunt photographed Corite founder Mattias Tengblad, who wants to restore agency—and income—to artists on Spotify: “He’s a veteran of the music industry, and while we had a nice, relaxed shoot, there was also a very interesting discussion regarding how its future might look. Corite sounds like it could really help musicians.”

Creating WIRED



CAPTURING A PLANETARY CHAMPION

“Being able to create a striking portrait of a brilliant mind like Friederike Otto made this WIRED story the dream assignment,” says Maria Lax, who shot our cover. “We used a gorgeous studio near my home in East London, with a team that consisted of friends—the atmosphere was so calm and creative that the day hardly felt like work.”



FIONA DUNLEVY

Dunlevy explores the world of medtech devices which harvest their power from the human body: “Humans are machines with parts that stretch, flow, quiver and beat. Scientists are now plugging into these energy sources to power new wearables.”



DELLE CHAN

Chan reports on artist Richard John Seymour’s use of the Landsat 8 satellite to reveal Earth’s unseen landscapes: “The work shines a spotlight on the omnipresent technological gaze, but also celebrates the beauty of nature.”



NANCY SCOLA

Scola profiles Tara McGowan, CEO of Good Information, a cohort of news sites in the US that could serve a greater purpose: “McGowan believes that these are the antidote to bad information, the hyperbole and lies that proliferate in social media feeds.”



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S W I S S M A D E

Globalization as we have known it is over

In 2005, the *New York Times* Pulitzer Prize-winning commentator Thomas Friedman declared the world to be flat—a metaphor suggesting that all organizations across the world were competing on a level playing field, other than the fixed costs of labor.

Friedman's belief—that geographic challenges had lost relevance—articulated a view of the world in which borderless trade would increase economic growth and precipitate seamless global integration. Politically, this view has been under threat for some time: resurgent nationalism in the US, China, India, the UK and some parts of Europe (not to mention the Russian version) has driven governments away from economic integration towards policies boosting local business interests.

As with so many other trends, this was accelerated by the pandemic: misfiring supply chains led to constraints on consumer goods, and shortages of PPE and ingredients for drug manufacture. In March 2021, the container ship *Ever Given* became stuck in the Suez canal, a beleaguered symbol of how the global economy had become so complex and fragile, that a

single incident could rock the world. It was determined that, for economies to flourish, inequality to be tackled, and institutions to be trusted, there needed to be a new focus on resilience and self-reliance.

This has been brought into sharper focus by Putin's war in Ukraine, which has highlighted Europe's energy dependence on Russian oil and gas. Once past the winter, the continent will need to find ways of decoupling from cheap Russian fuel.

This decoupling is already happening in technology: Citizens of Iran, Egypt, Syria, Turkey, Saudi Arabia, Belarus, the Philippines, and others experience surveillance and blockages of the internet, and there are very different approaches to systems, protocols, standards, data protection and privacy. The DC version of the internet, which champions freedom with a nod to data holders' property rights and free-market coordination, is different from the quasi-benevolent ideological version in China that powers its AI research; the consumer rights version championed in Brussels; and the nationalist version of India, which now insists that technology companies physically hold their data

in India, insisting that it's "... a national asset that the government holds in trust."

But the single event of 2022 that shows the end of globalization as we have known it? The Biden administration's CHIPS and Science Act, which allocates \$52.7 billion in federal subsidies to support domestic chip manufacturing. This isn't just to help the industry in the US—it's an attempt to curtail China's ambition of building a domestic semiconductor industry.

China currently purchases semiconductors, as it doesn't have the expertise to manufacture them. The semiconductor industry is a classic example of a sprawling, multinational supply chain. Today, there are only five companies in the world with the machines necessary for etching the design of a chip into silicone—none of them is Chinese. The CHIPS act makes it illegal for US companies to sell semiconductors, the machines necessary to make them, or for Americans to work for Chinese companies in this sphere. It prohibits *any company in the world* from doing the same. The legislation is an attempt to derail China's development of AI for use in both the private sector and military applications. This is policy designed for both the economy and national security.

Technology is now a tool for those working in both foreign and domestic policy in an age in which the world is moving towards more localized economies. But this isn't the end of networks—forming alliances based along shared goals and values will continue to be crucial for both governmental and corporate success. Welcome to the age of provincial-globalism.



Greg Williams
Deputy global
editorial director

ILLUSTRATION: GREGORI SAAVEDRA

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WORLD



A researcher stands on the summit of Mount Nyiragongo, in the Democratic Republic of the Congo, looking for a safe route down to the lava-filled crater.

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START



Edited by **Amit Katwala**

THE PERS

Armed rebel skirmishes, international politics and a corrosive atmosphere are just a few obstacles facing a British photographer's mission to gather life-saving visual data on one of Africa's most active volcanoes



It was four days after the eruption when Christopher Horsley ran into the rebels. The British photographer had spent the previous night camped near the summit of Mount Nyiragongo, a 3,470m-tall stratovolcano in the Democratic Republic of the Congo (DRC), enduring recurring aftershocks on the ash-covered slopes. The volcano's sudden eruption on May 22, 2021, wreaked havoc on the surrounding area: lava flows reached the outskirts of the city of Goma, 15 km away, cutting off a key highway; at least 364,000 people were displaced, with 120,000 of them losing their homes. An estimated 32 people lost their lives. Horsley went there after the initial eruption, escorted by scientists from the Goma Volcano Observatory (GVO) and a team of armed rangers from the Institut Congolais pour la Conservation de la Nature (ICCN), to try and install a camera and a timer system to mon-



About 500 meters inside Nyiragongo, two team members collect fresh samples from the lava lake.

itor Nyiragongo's lava lake—the ever-fluctuating store of molten lava within the crater, which has at times been the largest in the world. There were fears that the nearby Lake Kivu—which is thought to contain some 55 billion cubic meters of methane—might erupt as well.

The images from Horsley's camera system would be used alongside seismic data to help the GVO predict future eruptions.



Installing monitoring equipment also requires mountaineering skills—here, a researcher rappels through clouds of sulfuric gas to get in position.

But first, the group had to make it down the mountain. As they neared their base-camp, the group spotted rebel soldiers from the M23 military group—aka the Congolese Revolutionary Army—raiding their supplies. Fearing for his life, GVO staff gave Horsley a hoodie and a cap in an attempt to disguise his whiteness. Within moments, both rebels and ICCN rangers were pointing their AK-47s at each other.

After much back and forth, the outnumbered rebels retreated and the 30-year-old Liverpudlian—who had become interested in volcanoes as a child and has been photographing them since 2015—was able to get his system up and running.

Others have tried to study the DRC's volcanoes: The Belgian-backed GeoRisk Africa team formed the 15-station Kivu Geodetic Network in 2009, to monitor tectonic and volcanic activity using real-time telemetry. But the system was plagued by vandalism and lightning strikes, and cost up to €15,000 per year in repairs. (GeoRisk ended its relationship with the GVO in June 2022, after staff at the GVO accused GeoRisk of a “neo-colonial” attitude to sharing data—claims GeoRisk disputes.)

Believing he could do better, Horsley installed a basic Canon 5D camera and modem on Nyiragongo. Every half an hour, the camera uploads an image of the crater via the local cellular network to a Google Drive accessible by the GVO. By jettisoning the radio antenna required by telemetry, Horsley had reduced the impact of high

winds, and removed an obvious target for thieves. Along with a copper wire to mitigate lightning strikes and a case to protect against corrosive gas, his simple Canon formed a viable and sturdy alternative.

Another benefit is storage space. A video livestream provides low-resolution imagery, but could still take up thousands of gigabytes of disk-space. By uploading one image every 30 minutes to a cloud-based server instead, Horsley's data is easier to sort through, store, and study.

With Nyiragongo typically erupting every 20 years, using imagery alongside seismic data to monitor the rebuilding of its lava lake and any changes to its plumbing can be an indicator of the force, direction and potential timing of the next eruption. “We now walk with the volcano in our pocket; the activity of the lava lake almost no longer escapes our notice,” says Celestin Kasereka Mahinda, scientific director of the GVO. Before the installation of the camera, GVO scientists had to trek up to the crater three times a month—at

a cost of \$1,200 per trip. Now, Mahinda says, they only need to go once a month.

Next, Horsley has his sights on the nearby Nyamuragira volcano—Africa's most active. At present, rebel activity in the area means the volcano is only accessible by UN helicopter. Horsley hopes that installing a second monitoring system there—potentially using Starlink to overcome a lack of cellular data coverage—will reduce the risk, and cost, while enhancing understanding of local volcanic activity.

“Congo has a lot of challenges; not just volcanic instability, but political instability, which has made operating there difficult,” Horsley says. But, he is unlikely to give up peering down into the liquid Earth. “It's a strange thing, when you see this crater of molten rock glowing at 1,000°C,” he says. “It's like any fire, you just want to go and stand next to it.”

TOM WARD (@TomWardWrites)
is a journalist and author.



A rare ash emission from Mount Nyiragongo, days after the 2021 eruption that destroyed 3,000 homes.

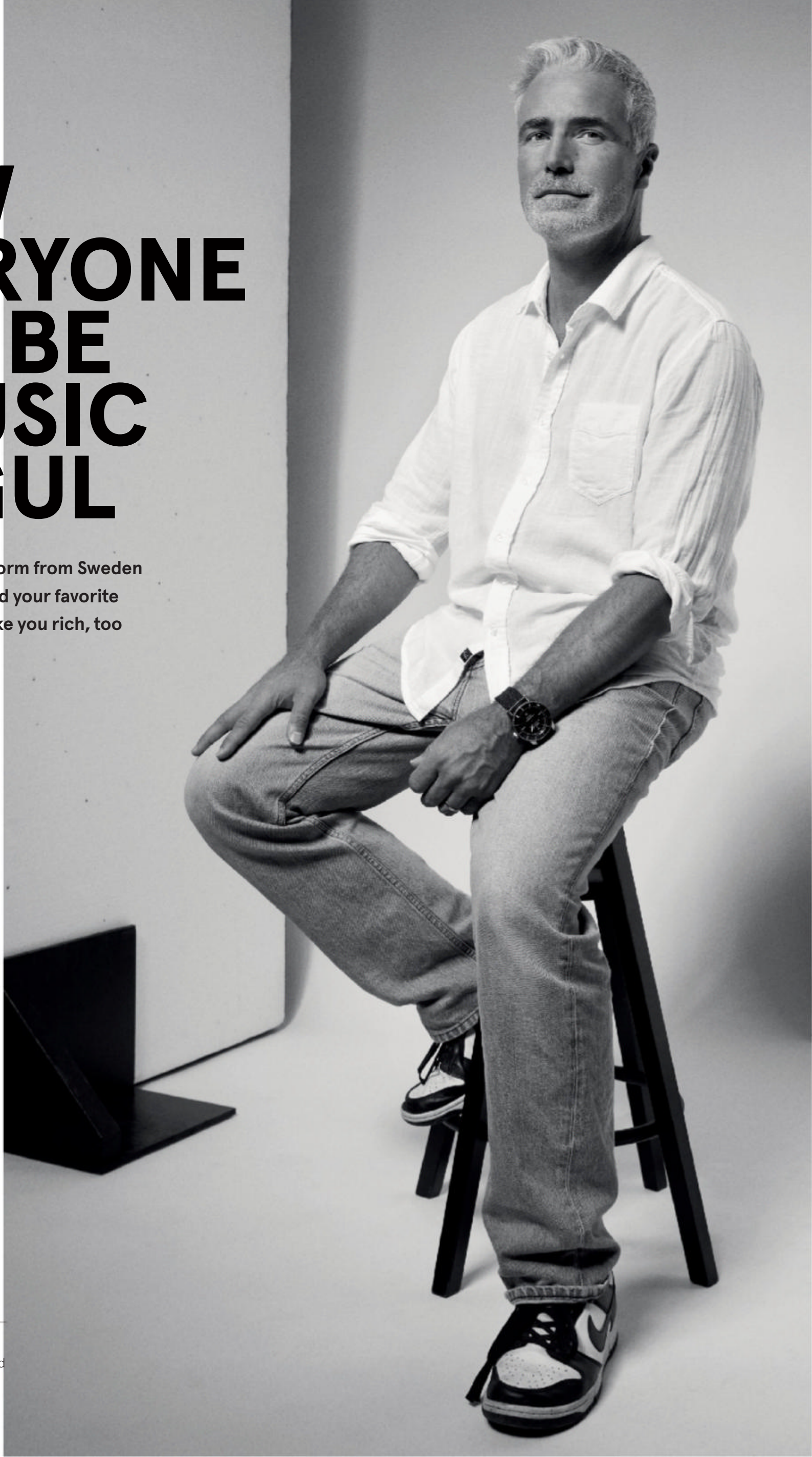
START

NOW EVERYONE CAN BE A MUSIC MOGUL

A fan-community platform from Sweden says it can help you fund your favorite artists—and maybe make you rich, too



Mattias Tengblad, cofounder of Corite, who believes Spotify is bad for musicians—and music fans.





In May 2006, Stockholm was the unlikely frontline in the fight for the future of the music industry. The city's police raided Swedish-owned file-sharing site, The Pirate Bay, and seized its web servers. Meanwhile, Daniel Ek was about to launch Spotify.

It was a turning point, says Mattias Tengblad, who had just taken over as commercial director at Universal Music in Sweden. "We had politicians defending young people for using The Pirate Bay. It was felt the industry was finished," he says. "But, in no time, Spotify had a million subscribers. In a few years it had two million Swedish users from a population of nine million."

But while Spotify was once the solution, today it is the problem. In July 2022, the UK Competition and Markets Authority (CMA) reported that artists with one million monthly Spotify streams earned just £12,000 a year after major label costs were deducted. Artists have little control over their music releases—but labels still demand they do a lot of the promo work themselves to stand out among the 70,000 new releases that hit Spotify every day.

Tengblad—who once toured in a band called Kosmic—is cofounder and CEO of Corite (as in "co-write") a platform that allows artists to crowdfund new releases. Fans get a small share in the profits of each track; artists keep creative control and a bigger slice of the pie from sales and streams. Corite takes a five percent cut.

"You first have to have about one million streams per month and be big on socials," says Tengblad. "Then, why wouldn't you

see if you can make the cash by yourself? You have the community, platform, and appeal—and that's where Corite fits in."

Tengblad cofounded Corite in 2019, alongside Emil Angervall, an industry veteran who he's worked closely with for 20 years. Artists who have migrated to Corite from major labels include DJ Alan Walker, one of Spotify's top-100 most-streamed artists of all time. Walker raised \$25,000 through Corite to crowdfund recent single, "Unity", which was streamed more than 4.1 million times in its first month. It's hoped that the track will pull in around £6.3m over the next five years, says Tengblad, giving early investors a return of five to ten times their initial investment.

But making money isn't necessarily the main selling point for Corite. Fans invest in small chunks: no more than \$10 at a time, and no single investor has a portfolio of more than \$1,000 at the time of writing. It's more about engagement. "If you have 3,000 fans, who have all invested \$10, actively working in your favor, that is huge," says Tengblad. "If Alan Walker wanted to, he could have let one rich guy fund the whole total, but that would have served no purpose. What is that one guy going to do to promote it?"

This community relationship is neglected in the industry, says Tengblad. "Spotify is a passive platform. It doesn't allow artists to speak to their fans directly. To engage you need Instagram where you have to create pictures, Twitter you have to say something bullish, TikTok it's a video or a meme. You can never gather your fanbase in one place or get feedback."

Tengblad claims Spotify's strategy is "demand control"—influencing the listener to like the music the streaming giant wants them to. The CMA report showed that Universal, Warner, and Sony between them owned either the recording or publishing rights to 98 per cent of the top 1,000 singles in Britain last year, with their catalogs accounting for 70 per cent of all streams in 2021. Corite hopes it can give artists and fans a chance to say who gets the biggest share in future.

ANDY JONES (@andyjoneswrites) is a UK-based journalist and broadcaster.



Young soccer players hoping to be talent-spotted by a big club rely on luck as much as skill: the off-chance that a scout just happens to see them playing the game of their lives. Now an AI tool may shorten those odds

SHOOT FOR FAME WITH AN AI SCOUT

It was the biggest match of Andre Odeku's career.

A week earlier, the 18-year-old forward had been playing in the seventh tier of the English football pyramid. Now, he was lining up for Burnley's Under-23 side in a trial game, with a view to signing for the then-Premier League club's academy.

"Their scouts invited me for a week's training," explains Odeku. "I'd never really been on those kinds of pitches before: the grass was so lovely and flat, and there were Premier League players training next to us. They liked what they saw, so they wanted to see me up close in a game." In footballing terms, Odeku had been plucked from relative obscurity, discovered while putting in Erling Haaland-like numbers for the development team of semi-pro north London side Haringey Borough; he would go on to score 25 goals in 18 games from the wing, and win the league's golden boot in the 2021-22 season.

But Odeku hadn't been spotted in the traditional way. Weeks before, in the mud of his local park in East London, he'd docked his phone, hit record, and begun doing as many push-ups as he could in 30 seconds. As dog walkers strolled by, he sprinted ten meters, launched into standing jumps and completed a chest-thumping set of lateral rebound hops. Watching it all was AiSCOUT, a virtual trials platform. Players perform athletic and technical drills, then get rated via an AI built by data specialists and leading scouts—the talent spotters who decide which few prodigies advance to being a professional footballer.

The founder of AiSCOUT, Darren Peries, began developing the app following his son's release by Spurs, aged 16. "Scouts from elsewhere had noth-

ing on him in terms of information, game footage or training metrics," explains Richard Felton-Thomas, the platform's COO and director of sport science. "While there is much data collection in the senior pro game, there isn't the same infrastructure in youth football—even at elite level." Following seven months of live testing, and the analysis of millions of data points, AiSCOUT is able to measure players' biomechanics, technique, and athleticism; feedback is delivered via the app within the hour. After players perform core athletic drills, the best are invited to show off their on-the-ball skills: Odeku's virtual Burnley trial included an agility dribble and seven-cone weave in the park.

In a game that's often ruthless in its discarding of young footballers, AiSCOUT offers a second chance—to both players and scouts. Odeku was released from Arsenal aged 11, then Brentford when he was 13; his diminutive size was cited as a

academy partner of both Burnley and Premier League giant Chelsea, could become an invaluable tool. "We help identify talent the scouts never knew existed. There are too many great young footballers slipping through the system. The technology helps target the right players faster, with data and insights, to make better decisions."

Odeku got an assist in his trial game with Burnley. He's subsequently been invited back for another match. From doing sprints and jumps in his local park to landing a Premier League academy trial, he says AiSCOUT has given him

← Andre Odeku, who managed to impress an AI, before impressing Burnley's scout.

factor. "Academies have a 'win now' mentality, so smaller players yet to mature are often let go," says Felton-Thomas. "Once that happens, there are no eyes on them, even if they've had a growth spurt. Now, players can be back in the system via AiSCOUT." Spotting a future superstar typically involves club scouts spending long hours on the road, traveling to half-empty community grounds and mud-caked Sunday League pitches. Relying upon an expert eye and word-of-mouth, there is more hope than expectation that they'll unearth the next footballing gem.

Felton-Thomas says the data-driven platform, founded in 2018 and now an

the gift that every young, promising footballer craves: confidence. "I came away believing I could make it," he adds.

AiSCOUT has also offered Odeku, and many other young players, an opportunity. "Normally, it's based on luck whether you're scouted: you've got to have consistently unreal performances and stats, hope the right people hear about you and watch you play live," says Odeku, who is now in Haringey's senior side. "Now, it's facts and stats-based: it's another avenue for young players to have a chance of making it."

ALEX CHRISTIAN (@alextchristian) is a culture, technology and business writer.

In February 2022, Graeme Cavers and his team of archaeologists set off in search of a mysterious underground passage called a “souterrain”. There are around 500 of these Iron Age structures scattered throughout the Scottish Highlands, but nobody knows what they were built for, and no one has ever discovered one intact.

“Perhaps they were for storage, such as grain in sealed pots, or dairy products like cheese,” says Matt Ritchie, resident archaeologist at Forestry and Land Scotland. “Perhaps they were for security, keeping valuables safe, or slaves or hostages secure. Or perhaps they were for ceremonial purposes, for household rituals, like a medieval shrine or private chapel.”

Site surveys can help shed light on the condition and structure of souterrains, but they can take at least a week using traditional methods, says Cavers, whose company AOC Archaeology was enlisted by Ritchie to help map the Cracknie Souterrain in Scotland’s Borgie Forest.

Manual measurements using a device called a theodolite—difficult to use in dark, cramped tunnels—have been replaced by laser scanners, which have improved markedly in the last few decades. “They used to connect to an external laptop,” Cavers says. “The data could only be recorded as fast as that connection. It was done over an Ethernet cable, so it was relatively fast. But even then, the first laptops that I used with a scanner had 2GB of RAM. That was top of the range. And a laptop cost an awful lot of money in those days.”

Now, after crawling into the Cracknie Souterrain through a 50 cm opening in the ground, Cavers can deploy a device the size

→ Scotland’s souterrains are remote and highly challenging places to conduct archaeology.

of a shoebox: a Leica BLK360 laser scanner.

Set on a tripod in the dank one-meter high passage, at the push of a button the BLK360 swivels into action, firing a laser against the walls of the souterrain 10,000 times a second. It lets Cavers and his team take millions of measurements in under an hour—Cracknie yielded 50 million in just a few hours. “To do the equivalent of what we did with a theodolite, you would be there a *long time*,” he says.

Collecting such large datasets presents a challenge in itself. “Today, we’re coming back with half a terabyte [of data],” Cavers says. “And we might do a couple of hundred projects in a year. It starts to get very difficult to manage from an IT point of view. And obviously we’re archaeologists, we’re supposed to be creating archives that are perpetual, for the long term.”

The data does, however, pay its dues. Cavers would have once had to draw or photograph the souterrain from within the dark passageway. Now he uses software—Trimble RealWorks, NUBIGON, and Blender—to produce accessible 3D multicolored “point cloud” models.



Team members can then view the models from any angle, measure distances between objects, and change the colors to show variables such as height and density. It means archaeologists like Ritchie can teach people about archaeological sites without having to actually go there.

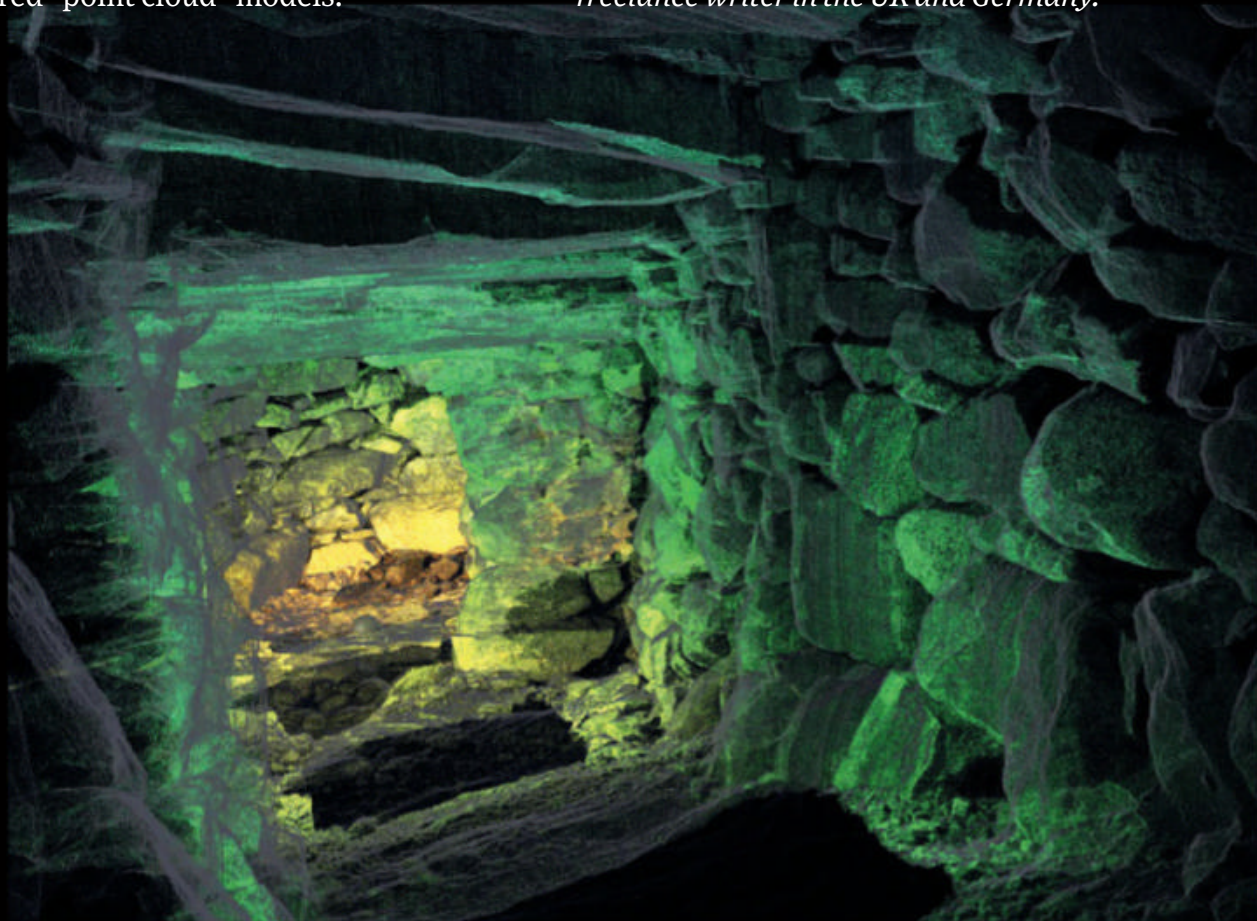
“[Cracknie] is very remote,” Ritchie says, which means it’s poorly suited to guided tours or for use by educational panels, but a 3D model can be viewed from anywhere—Ritchie could even print out a scale model and display it in a museum. The technology is making Britain’s cultural heritage more accessible—and might one day help archaeologists solve the mystery of Scotland’s souterrains.

CHARLIE METCALFE (@cafmetcalfe) is a freelance writer in the UK and Germany.

PHOTOGRAPHY: MATT RITCHIE

LASERS ILLUMINATE THE PAST

With digitized archaeology, the mysterious Iron-Age souterrains of the Scottish Highlands are accessible to all



↑ A point-cloud model, created by scanning the souterrain with a laser, records every detail in 3D.

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A

round 1.8 billion years ago, in a distant galaxy, two vast black holes spiraled into each other, and their cataclysmic merger sent ripples through the very fabric of the universe. On August 14, 2017, those ripples in spacetime—called gravitational waves—washed over Earth, where they were detected by a newly-upgraded facility in the Italian countryside.

The Virgo interferometer is an observatory for gravitational waves, set among Tuscany's rolling hills. Three days later, it captured another ripple, this time from the merger of two neutron stars. With help from LIGO—a pair of similar interferometers in the United States—scientists were able to pinpoint where the merger happened in the sky, and point their regular observatories in the right direction to eyeball the event across the electromagnetic spectrum.

It was the dawn of a new era of “multi-messenger” astronomy, in which it's now possible to observe powerful cosmic events not just through the light that reaches us from space, but also through other “messengers”, including

CATCHING A COSMIC WAVE IN TUSCANY

Ripples in spacetime are ancient signals from interstellar cataclysms. Virgo lets researchers measure them as they wash through our planet



gravitational waves. “We had spent years making presentations to colleagues saying we will open a new window on the universe, but nobody really believed it,” says Giovanni Losurdo, a physicist who has been involved in Virgo since 1992. “Several times I was discouraged—it seemed too difficult—so when this happened, it was just a fantastic reward.”

Gravitational waves begin as a surge that weakens the farther they spread, like the diminishing ripples made by a stone thrown into a pond. By the time they reach Earth, their signals are miniscule, which means detecting them is a monumental challenge. To meet it, Virgo, LIGO (the Laser Interferometer Gravitational-Wave Observatory) and Japan's KAGRA

An aerial view of the Virgo gravitational wave detector near Pisa, Italy. The two laser tunnels run off at a right angle.



(Kamioka Gravitational Wave Detector) all employ the same ingenious technique.

A laser is fired at a beam splitter, which sends two identical beams down two identical tunnels, laid out at a right-angle to each other in an L-shape. At the end of each tunnel there's a mirror, which sends the beam right back to the splitter, where the light combines and can be measured by photodetectors.

When a gravitational wave passes through Earth, it causes space itself to stretch in one direction and compress in the other, so the two “arms” of the detector actually grow and shrink by



Inside Virgo's 3km-long North arm. The main 1.2m-diameter vacuum tube is left; a smaller “squeezing” cavity is to the right.



A researcher inspects one of
Virgo's 35cm-diameter mirrors.





Researchers in the laser lab must don laser safety-goggles and a coverall to protect Virgo's optics from dust and dirt.

tiny amounts. This means each beam of light travels a slightly different distance, which shows up in the recombined laser light pattern as a spike in frequency called a “cosmic chirp”—this is the gravitational wave signal.

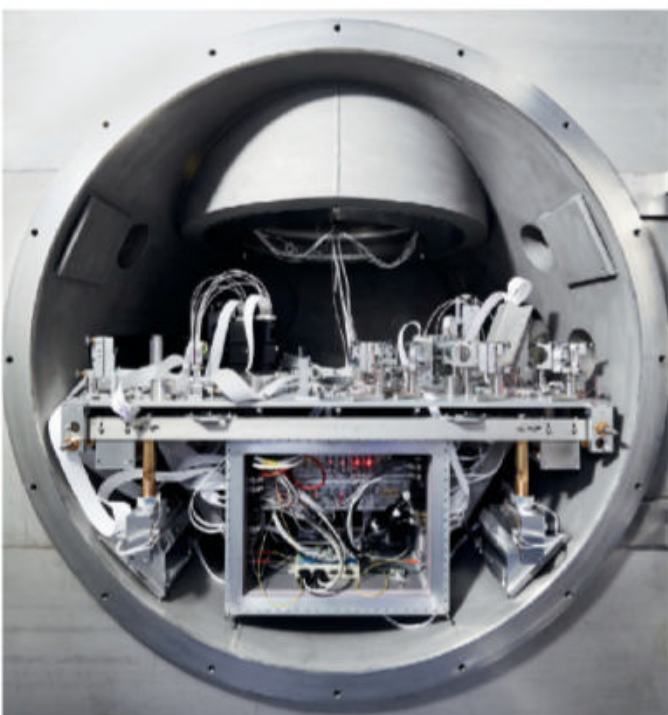
To measure it, Virgo relies on state-of-the-art equipment. The mirrors at the end of each tunnel are made of a synthetic quartz so pure it absorbs only one in three million photons that hit it. It's polished to an atomic level, leaving it so smooth that there is virtually no light scattering. And it's coated with a thin layer of material so reflective that less than 0.0001 per cent of laser light is lost on contact.

Each mirror hangs beneath a superattenuator to protect it from seismic vibrations. These consist of a chain of seismic filters that act like pendulums, encased in a vacuum chamber inside a 10-meter-tall tower. The setup is designed to counteract the Earth's movements, which can be nine orders of magnitude stronger than the gravitational waves Virgo is trying to detect. The superattenuators are so effective that, in the horizontal direction at least, the mirrors behave as if they were floating in space.

A more recent innovation is Virgo's so-called “squeezing” system. This combats the effects of Heisenberg's uncertainty principle, a weird feature



A detection bench suspended in a vacuum chamber, which hosts the photodetectors that measure Virgo's output light.



of the subatomic world that says that certain pairs of properties of a quantum particle cannot both be measured exactly, at the same time. For example, you cannot measure both the position and the momentum of a photon with absolute precision. The more accurately you know its position, the less you know about its momentum, and vice versa.

Inside Virgo, the uncertainty principle manifests as quantum noise, obscuring the gravitational wave signal. But by injecting a special state of light in a pipe that runs parallel to the main vacuum tubes and then overlaps the main laser field at the beam splitter, researchers can “squeeze”, or reduce, the uncertainty in the laser light's properties, reducing quantum noise and improving Virgo's sensitivity to gravitational wave signals.

Since 2015, nearly 100 gravitational wave events have been recorded over the course of three observing runs by Virgo and its US counterpart LIGO. With upgrades to both facilities, and KAGRA joining the party, the next observing run—which starts in March 2023—promises much more. Researchers hope to gain a deeper understanding of black holes and neutron stars, and the sheer volume of expected events offers the tantalizing prospect of building a picture of the evolution of the cosmos through gravitational waves. “This is just the beginning of a new way of understanding the universe,” says Losurdo. “A lot will happen in the next few years.”

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W

The local whisky with a global impact

There are only a handful of drams you can drink with a clear conscience: Bruichladdich's Classic Laddie is one of them

hisky has long had a connection to nature, but the sustainability of whisky distilleries hasn't always been something to raise a glass to. Europe's first gin and whisky distillery to be B Corp certified is changing that, thanks to its unique bottle and minimal packaging.

Bruichladdich Distillery, situated on the island of Islay, has become a testing ground for trialling more environmentally friendly methods. It works closely with the local agricultural community to source its raw ingredients, ensuring all its barley is sourced within Scotland, 50 percent of which is grown on Islay with the help of their farming partners—its Classic Laddie is an all-natural, single malt whisky, bottled at 50 percent ABV, whose raw ingredients can be traced to individual Scottish farms. Bruichladdich is also trialling hydrogen technology at its distillery to reduce its carbon output,

and it is reducing packaging and waste across the business, including removing secondary packaging from its products.

“As a B Corp certified company, we are part of a movement to use our business as a force for good, making decisions that positively impact our people, community and the planet,” says Douglas Taylor, CEO of the Bruichladdich Distillery Company.

In 2021, Bruichladdich Distillery encouraged its customers to go “One Tin Lighter” and opt out of secondary packaging with their whisky, shunning the round tins in which the bottles are served. It has now gone further, removing all outer packaging from its Port Charlotte range.

While the majority of the tins were made from tin plate—one of the most widely recycled materials—removing the secondary packaging altogether means less steel is used as part of the metal mix.

“We’re accustomed to thinking that single malt Scotch must come with outer packaging, while premium gins, vodkas and mezcals are readily bought without,” says Taylor. “While the outer packaging of our Port Charlotte brand is both beautiful and recyclable, the need to act and influence a shift-change in perceptions of quality feels increasingly necessary.”

The heavily peated range of Port Charlotte whiskies, which are distilled at Bruichladdich, are peated to a heavy-weight 40PPM. The whisky is trickle-distilled through tall, narrow-necked stills, giving it a powerful peaty flavor alongside the elegance and finesse that is expected from the company. The individually selected casks showcase the classic, floral and elegant house style that Bruichladdich is best known for.

The whisky is produced by the island community in which Bruichladdich is based, with the company employing

**‘As a B Corp company,
we are part of a movement
to use our business
as a force for good’**

over 80 permanent staff—making it the Scottish island's biggest private employer. Its connection to the island—and by extension, our planet—makes it the environmentally-conscious whisky connoisseur's drink of choice.

You can purchase Bruichladdich's Classic Laddie at Waitrose Cellar, £45



Q

Quantum computers have a huge problem. Or, to be more accurate, lots of incredibly tiny ones. These futuristic devices promise to revolutionize everything from the financial industry to drug discovery by tapping into the power of quantum uncertainty—instead of using bits, like your laptop or phone, quantum computers use qubits, which means they’ll be able to perform certain tasks much faster than traditional computers, and may be better at simulating natural processes.

Tech giants including Google, Microsoft and IBM are racing to build quantum devices, but collectively the field is mired in an era known in the business as “noisy-intermediate scale quantum”, or NISQ. Today’s quantum computers are delicate devices that can be thrown off-course by the slightest environmental interference: they’re slow, small-scale, and not that accurate, which means that right now, they’re kind of useless.

Sabrina Maniscalco is hoping to change that. She is cofounder and CEO of Algorithmiq, one of a handful of startups developing software for the noisy quantum computers we have access to today. “Software and algorithms for near-term devices are key in order to unveil and unlock useful industrial applications,” she says.

The company emerged from research at the University of Helsinki, where Man-

iscalco is professor of Quantum Information, Computing and Logic, after stints in South Africa and Edinburgh, and her native Sicily. “It started with trying to figure out the best applications for these early-stage quantum computers,” she says.

They settled on the problem of “noise”. Algorithmiq is developing ways to counteract the noise that afflicts quantum computers: not the whirl of a cooling fan, but the tiny environmental changes that can nudge qubits out of a delicate state called superposition. It’s this state—think of it as neither 0 or 1, but both at the same time—that makes quantum computers

so powerful, but also so difficult to build.

Algorithmiq is figuring out sophisticated methods to model noise and mitigate against it so that early-stage devices can be used for useful experiments. To begin with, the company is focusing on chemistry simulations—a promising potential use-case for quantum computers because they mimic the uncertainty of nature. It’s benchmarking its noise reduction algorithms by simulating molecules such as dichromium—which is simple enough to be simulated with current quantum computers, but complex enough to show the power of these devices. Maniscalco says Algorithmiq, which has recently partnered with IBM, is planning to apply the same principles to more complex structures, with potential applications including drug discovery in the pharmaceutical industry. “We think of ourselves as the first quantum biotech company,” she says. *algorithmiq.fi*
AMIT KATWALA is an editor at WIRED.



QUIET QUANTUM: WE NEED SHUSH FOR SUPERPOSITION

Today’s quantum devices are being held back by the problem of ‘noise’—but by modeling and mitigating its effects, Algorithmiq can harness the power of qubits

↑ Sabrina Maniscalco, cofounder and CEO of quantum computer software firm, Algorithmiq.

POWER FROM THE PEOPLE

'Batteries not included' could be the norm for new electroceuticals

H

umans are complex machines, with moving parts that bend, squish, stretch, flow, quiver and beat. Scientists are now plugging into these energy sources to solve a common problem afflicting sensors, wearables and implanted medical devices—the dreaded flat battery.

Devices that are self-powered by design could be the solution, and researchers have discovered that the human body itself can be a handy power source—and just in time to supercharge the exploding market in wearables. “Electroceuticals” are starting to challenge pharmaceuticals in medicine, so more people will depend on devices such as implanted electrostimulators and pacemakers to stay healthy.

“Biobatteries” and energy scavenging could make these devices energy-autonomous, removing the need for invasive surgery to replace dead batteries. As a bonus, this wireless world would avoid implanted charging cables being dislodged or becoming infected—problems that are all too common today.

Scientists have been working on body-powered devices since the early 2000s—until now, the tech has been too energy-hungry for the minute amounts of electricity that can be harvested from humans. But after two decades of advances, today’s devices consume ultra-low amounts of energy, throwing open the gate to myriad ideas and prototypes that draw power from the people.

FIONA DUNLEVY is an Irish science-writer based in France.



A cellular powerhouse

German startup CELTRO uses arrays of microneedles to harvest energy from thousands of body cells. Its first product will be a tiny autonomous pacemaker. “A muscular contraction, like the heart, starts at one point and then propagates through the whole heart muscle,” says CEO and cofounder Gerd Teepe. “Our idea was to harvest energy at multiple points to use this avalanche effect.” celtro.de

Paper fuel-cells

French startup BeFC is building biobatteries with green credentials. Its fuel cell uses layers of carbon, cellulose, and glucose—plus a sprinkling of proprietary enzymes. Adding a drop of fluid, say blood or urine, sets off a reaction that generates electricity. The compostable paper patches could power single-use diagnostic devices and continuously operating sensors, such as glucose-monitoring kits. befc.global



The human body already generates all the power needed for many medical devices.

Piezo patches

Italian startup PiezoSkin says it has developed an ultra-thin piezoelectric skin patch that can simultaneously measure movements and draw power from them. In one study, it used the patch to monitor neck movements in people with the swallowing issue dysphagia—but the firm's biocompatible film could also harvest power from other body movements. piezoskin.com

Feeling the heat

Humans radiate around 100 Watts a day in thermal energy. Swiss startup Mithras thinks it can harness this heat. Its thermoelectric generators, or TEGs, create electricity by exploiting the temperature difference between the body and the environment. Mithras estimates that with a 5°C difference, a 12 cm² TEG skin patch could power a cochlear implant. mithras.tech



My quivering heart

Paris-based CAIRDAC is designing a pacemaker that's powered by the heart itself. Its leadless pacemaker is packed into a capsule containing a piezoelectric energy harvester—heartbeat oscillations are converted into electricity and stored until the device senses that the heart needs a jolt to reset the rhythm. The startup recently raised €17m in Series-A financing to continue preclinical testing. cairdac.com

Interior illumination

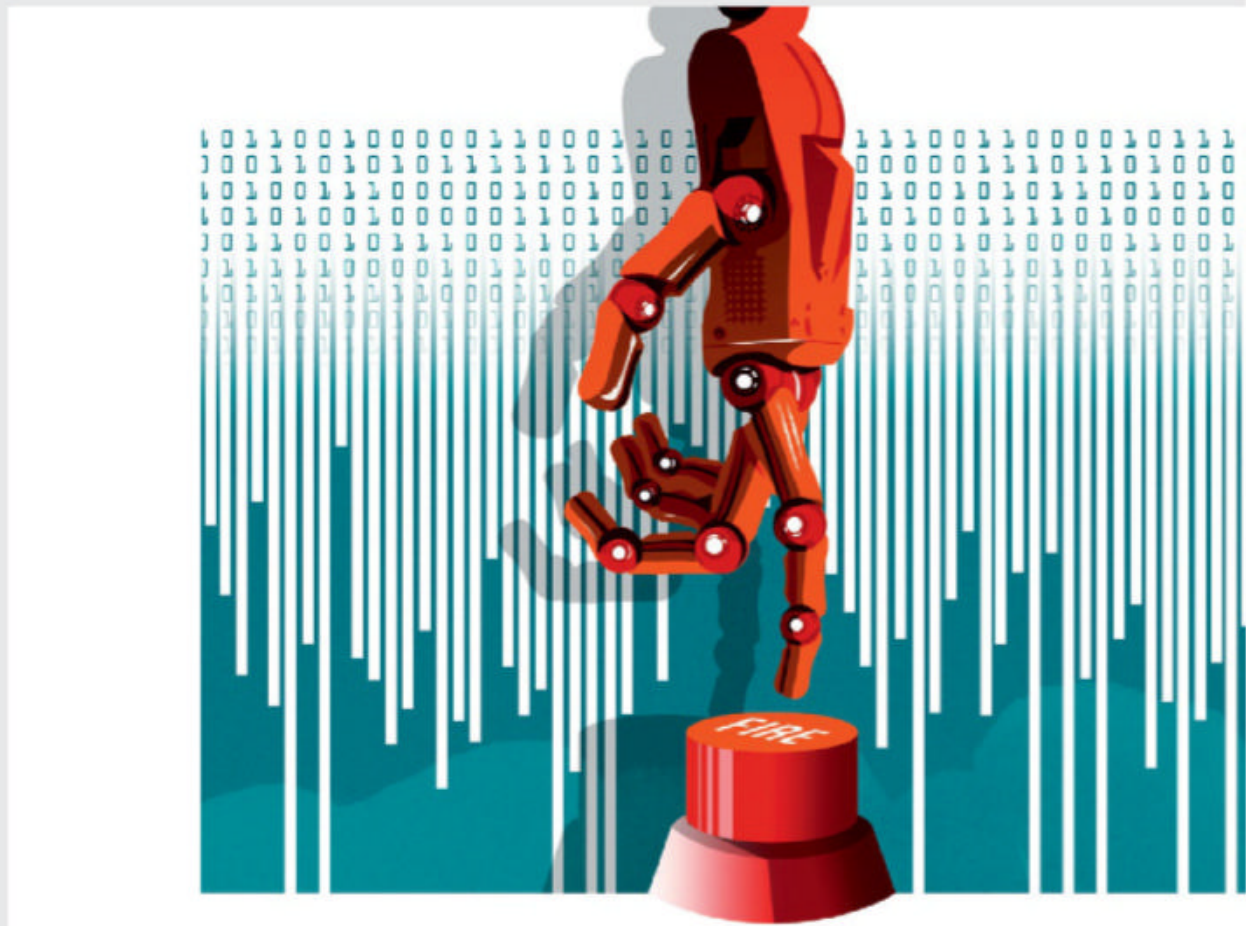
Solar panels could soon be lighting up medtech. Researchers from Monash University in Melbourne have found that a solar panel placed under the skin (between the neck and the shoulder is best, apparently) will still yield up to 10 percent as much electricity as one in direct sunlight—enough to power an ultra-low consumption sensor. A couple of hours in the sun can run an implantable temperature sensor for 24 hours.

The hydroelectric heart

Mini-turbines could turn blood flow into electricity, according to University of Bern researchers. Their torpedo-shaped turbine could be implanted into a heart blood vessel, generating electricity from blood flow, much like a hydroelectric power station. Blood clots forming on the blades of the turbine is still an issue, but in lab simulations, the turbine generated enough energy to power commercially available leadless pacemakers.

In the final phase of the Libyan civil war, in 2020, Prime Minister Fayez al-Serraj launched a new offensive against the forces of renegade commander Khalifa Haftar. According to a United Nations report published the following year, al-Serraj's troops deployed weapons of a type that may never have been used against humans before: lethal autonomous weapon systems (LAWS). These devices—which allegedly included kamikaze drones—“hunted down and remotely engaged” Haftar's logistics convoys and soldiers. “The latter's units were neither trained nor motivated to defend against the effective use of this new technology,” read the report, “and usually retreated in disarray.” It's unclear whether these devices killed anyone or were operating in autonomous mode during the attacks, but the incident drew attention to a looming shift in how we fight wars.

LAWS are an emerging category of munition, and they're quite unlike any other. These weapons aren't just about bigger bangs or greater accuracy, they are themselves decision-making agents: they use artificial intelligence (AI) to identify, select and engage a target—without human input. LAWS could take many forms, from swarms of micro-drones to autonomous tanks or submarines, but the quality of their strategic thinking, their capacity for intricate coordination, the speed with which they're able to attack—all of these things have led many experts to argue that those who possess this technology could enjoy a dramatic, asymmetric advantage over those who don't. Some believe they will bring about a revolution in warfare as significant as that of the atomic bomb.



Robotic weapons are coming. What should we do about it?

Artificial intelligence is going to war, raising profound ethical and safety questions

By their very nature, these weapons are contentious, because they throw up profound ethical and safety questions. Since 2013, the campaign group Stop Killer Robots has argued for LAWS to be outlawed. Right now, states are at loggerheads over what to do. In 2021, a majority of the 125 nations that subscribe to the UN's Convention on Certain Conventional Weapons demanded new controls on this technology—but the talks failed to reach unilateral agreement. The likes of Russia, the UK, and the US have historically opposed a preemptive ban, and are said to be investing heavily in the development of such systems. The war in Ukraine has thrust the LAWS conversation

once again into the spotlight, with speculation that Russia could deploy drones that operate autonomously.

It seems a new era of warfare could well be about to dawn, and we need to think deeply about the implications. WIRED convened a roundtable of experts, in partnership with defense, aerospace, and security firm BAE Systems, to discuss the most compelling arguments on either side of the debate, and consider the path ahead.

The multitude of objections to LAWS include technical problems such as algorithmic biases, unreliability,

LAWS could decide
—without any input
from humans—to
deploy lethal force

and unpredictability. Many people, however, simply recoil at the ethics. As UN Secretary General António Guterres put it in his address to the General Assembly in 2018: “Let’s call it as it is. The prospect of machines with the discretion and power to take human life is morally repugnant.” And even if we did decide that it was acceptable to allow machines to take lives within the parameters of existing humanitarian conventions, there’s a further issue. “Accountability and plausible deniability is a major concern,” says Gopal Ramchurn, professor of artificial intelligence at the University of Southampton and director of the UKRI Trustworthy Autonomous Systems Hub. “If the machine makes a mistake—they wrongly classify something and target it—the human can say, ‘Well, I didn’t have anything to do with it, that was

the machine.’ That is the key issue for me.” To Stuart Russell, professor of computer science at University of California, Berkeley—and an advisor to the Future of Life Institute, which seeks to mitigate existential threats

**“It seems a new era
of warfare could
well be about to dawn,
and we need to
think deeply about
the implications”**

to humanity—the primary concern is not ethical but practical. “To me the biggest argument, and it’s often omitted, is that autonomous weapons decouple the number of weapons you can deploy from the number of people you need to deploy them,” he says. “So you can press one button and kill 10 million people. That seems like a really bad idea.” You might argue the same is true with a hydrogen bomb, but only very few states can produce one—that’s not the case with autonomous weapons. “You can easily imagine these will be manufactured and sold in the millions or tens of millions.”

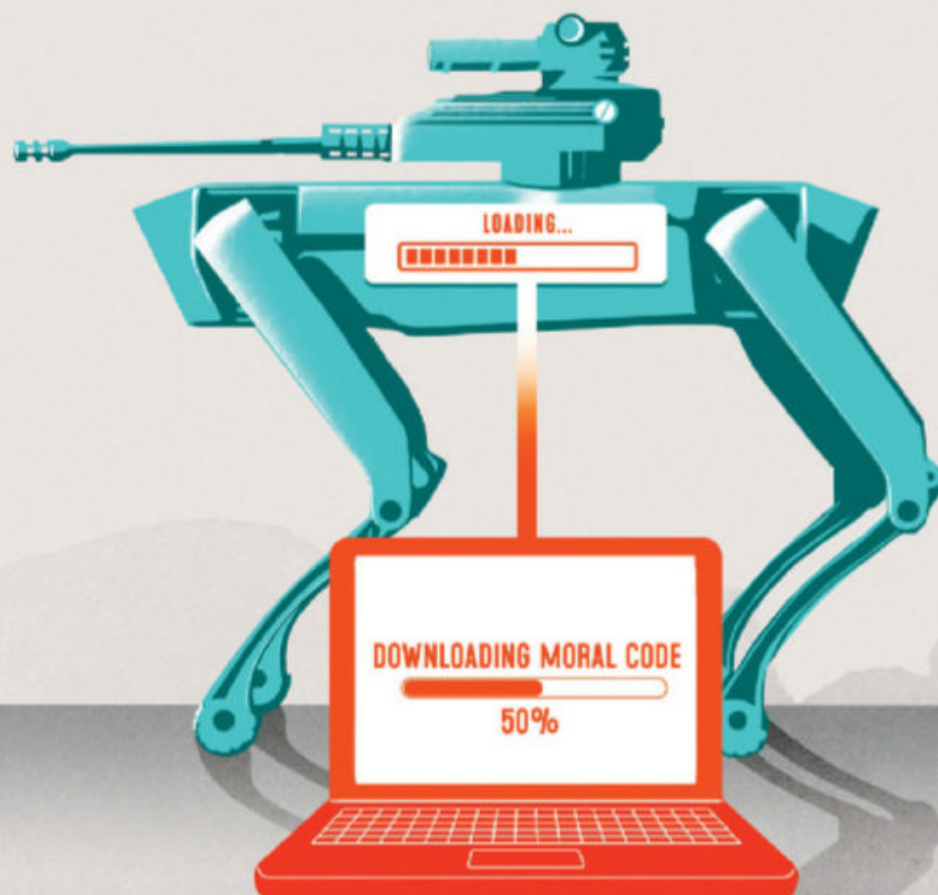
Much of the debate around how to

Scan the QR
code to read
the full story



treat this issue focuses on the prospect of an international ban. Critics point out that if you can’t get all nations to agree to a ban—which seems likely to be the case in the current geopolitical climate—then it only takes one unfriendly nation to develop LAWS to put you at an unacceptable disadvantage. Lucia Retter, research leader in defense and security at RAND Europe, believes that it would also be impractical: “With conventional weapons that have been banned, you can more or less physically monitor whether actors have them or not, but you can’t do that with LAWS,” she says. A drone may not be autonomous right now, but a firmware update could provide it with autonomy tomorrow.

So, what should we do about this complex yet pressing problem? Read the full story by scanning the QR code above.



SPECULATIVE SPECIALIST

Neal Stephenson isn't just an award-winning sci-fi author—he possesses an uncanny knack for predicting Silicon Valley's next big things, from cryptocurrencies to the metaverse

W

What does Neal Stephenson know?

The science fiction author, 63, has no (living) rival when it comes to foresight. Some of his novels arguably predicted our current technological landscape, thirty years in advance. *The Diamond Age* famously inspired Amazon engineers charged with developing the Kindle e-reader, whose early codename, Fiona, takes after the book's protagonist. *Cryptonomicon* is a tale of encryption and electronic money, written a decade before the birth of cryptocurrency. And then there is *Snow Crash*, the dystopian parody where the concept of the metaverse was first envisioned.

Being a gifted forecaster, though, is a nuisance as much as a blessing. When, in late 2021, metaverse-mania reached a fever pitch following Facebook's rebrand to Meta, Stephenson recalls "watching the whole thing in amazement."



Neal Stephenson's sci-fi inspiration often comes from his work in the tech industry—such as his launch of a payment system for the metaverse.

"I was ramping up for a [*Termination Shock*] book tour, and everywhere I went they would ask questions about the metaverse. It became the metaverse tour," Stephenson says. "I just had to laugh. But once I got over that reaction, I began thinking, 'Is there some way that I could do something useful here?'"

The answer to that question is LAMINA1, a blockchain company Stephenson launched in June alongside Bitcoin grandee Peter Vessenes, whose objective is creating an accessible payment system for the impending metaverse. Despite Meta's attempt to plant a flag on the idea, Stephenson is a believer in an "open Metaverse" model—a virtual world that is not beholden to any specific organization. All the same, he has no time for the dime-a-dozen snarks about the very construct of the metaverse—which some critics, including yours truly, have denounced as a corporate escapist fantasy from a material world riddled with chaos, violence, and environmental collapse. "[In *Snow Crash*] it was always my intention to have the metaverse be a neutral thing in a world that, yes, is dystopian," he says. "It's a tool that can be used in different ways. We'll see it used in positive and negative ways for sure. I mean—look at Twitter."

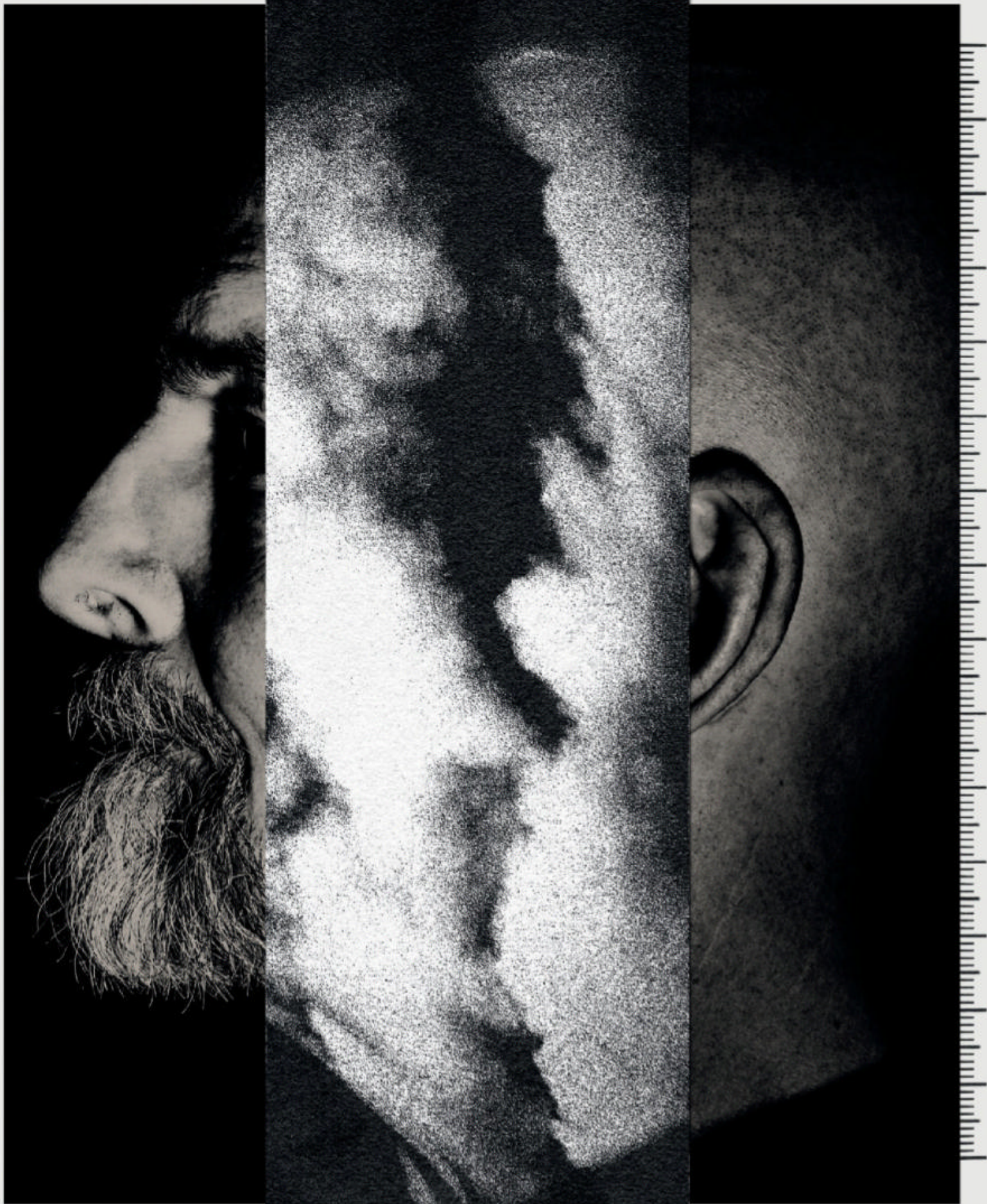
LAMINA1—he is chairman as well as cofounder—is not Stephenson's first foray into the tech industry: his resume includes stints at Jeff Bezos' space venture Blue Origin, tech-focused private equity outfit IV Labs, and augmented reality startup Magic Leap. "It's not helpful to just work eight hours a day on writing," Stephenson says. "You have to give some time for the brain to do something else." He typically writes in the morning and works on other businesses in the afternoon. This time,

however, he will take the whole of 2022 off from writing to focus on LAMINA1.

Getting out into the world and meeting tech visionaries might be key to Stephenson's knack for forecasting. It was through spending time among California's techno-libertarians, aka the Cypherpunks, that he first got a sense of how some people were hell-bent on creating digital stateless money—hence *Cryptonomicon*. "I come from a family of engineers and scientists," he says. "It's always been easy for me to talk to hackers, engineers, scientists—and to understand how they think."

But what do Stephenson's perceptive antennae intuit is coming—say—thirty years from now? Two things, he says: even more extreme political polarization, and the tackling of climate change through carbon capture and storage. (And yes, Stephenson has already joined a non-profit dedicated to carbon capture.) "Our survival depends on removing extremely large amounts of carbon from the atmosphere," he says. "It'll be the biggest engineering project in history." lamina1.com

GIAN VOLPICELLI (@Gmvolpi)
is a former WIRED senior writer.



237.2 kPa

Sulfur dioxide



Can a seashell shape an alternative to plastic?



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THE FIRST RULE OF CRYPTO-CLUB ...

... Is we definitely talk about Crypto Club. Networking for the NFT-enabled is the aim of London's latest membership

There was a time when Blacks was one of Soho's most infamous members' clubs. Founded in 1992 as a building-sized riposte to exclusive social club White's, Blacks was pitched to a milieu of artists, creatives, and decadent *jeunesse dorée*. The venue features brightly colored furniture, has dreamy prints hanging on walls, and affects a slightly dilapidated style—until recently, it kept a bed in a room near the main lounge, in case guests felt an itch for night-time horseplay. Its cofounder, Tom Bantock—poacher and supposed three-time murder suspect (the charges, he'd claim, were always dropped)—stalked the corridors until his death in 2014. Things are different now.

On a recent Wednesday afternoon in July, a guest sitting in Blacks' bar would have spotted a fashionable couple and a man in a T-shirt bearing the logo of cryptocurrency exchange Binance, debating decentralized finance, NFTs, and the price of Bitcoin. That was not simply a consequence of the current, crypto-crazed zeitgeist, but of a precise business choice by Blacks' new owners. London-based outfit Crypto Club Global (CC-GBL) took over the venue in spring 2022, and officially reinvented it as a club geared towards cryptocurrency and blockchain professionals, enthusiasts and believers. Dan Collingridge-Padbury, one of the cryp-

to-pilled founders—alongside Jonathan Willis and Adam Leon—says that they decided to launch a club after running meetups devoted to crypto, and feeling a yearning for a space of their own.

"We were looking for private members' clubs servicing blockchain and Web3 people. We hoped to expand our network," says Collingridge-Padbury, who used to be a military helicopter pilot before pivoting to tech. "We discovered that there was no such club—but also that there were a lot of meetup groups and organizations that were not interacting with each other." That, he says, convinced them that there was a market for a

membership and the 625 crypto-infused newcomers seem to get along very well: only one person (out of 800 pre-takeover members) has left because of the rebrand. He adds that the old guard sees something of their past selves in the crypterati. "These people—they're innovators, they're contrarians, they're anti-establishment," he says. "And crypto is the new version."

In time, CC-GBL hopes to create a network of clubs in various parts of the world, all accessible to its members.



crypto-club to bring all those people to mingle in one place. Initially they tried to raise the funds to build a whole club from scratch, by selling NFTs to prospective members, but the campaign fell short of the initial target of £6 million. Eventually, they found out that Blacks was looking for a buyer, and their budget was sufficient to make an offer. "Had we not come in with a new vision, this club would have failed, financially," Collingridge-Padbury says. "It lacked direction."

As of summer 2022, Blacks is in the middle of a member-recruitment drive, selling £2,000 life-long memberships under the guise of transferable NFTs that can be bought both with crypto and fiat money. (Honorary members include former Health secretary Matt Hancock who, since his fall from grace, has busied himself with crypto.) The bar and restaurant do not accept payments in crypto yet, but that will change soon; the contemporary art will give way to NFT-backed paintings; crypto-focused shindigs and events will abound.

Collingridge-Padbury says that, so far, the old

Early plans for a Metaverse-based club, however, have been shelved for the time being. "I don't think the technology is there yet," says Collingridge-Padbury. And what if the whole crypto craze eventually dies down? Collingridge-Padbury says that Blacks will simply restyle itself as a place where innovators and contrarians can come together and hope for serendipitous encounters or inspiration. "If we're always bringing in interesting people who are at the cutting edge, on the margins of society—who are working on things that are considered taboo—that's how we can keep being relevant, even beyond blockchain and crypto," he says. blacksclub.com

GIAN VOLPICELLI (@Gmvolpi) is a former WIRED senior writer.

↑ A freshly-minted membership at Blacks will set you back £2k to mingle with the crypto-cream.

While it may be nearing the end of its ten-year fuel supply, NASA's Landsat 8 still has lots to show us. With the help of a visual creative, this satellite is capturing images of Earth worthy of an art exhibit

AN ARTIST'S EYE IN THE SKY

Satellite imagery is used for everything from tracking weather to measuring urban growth. Now it's also being harnessed to make art. This is exactly what British-born, BAFTA-nominated filmmaker, architect, and visual artist Richard John Seymour has done with *Landsat Works*, an award-winning series of artworks featuring data from the Landsat 8 satellite.

Launched into space in February 2013 and jointly managed by NASA and the United States Geological Survey (USGS), Landsat 8 collects high-resolution imagery of the Earth's surface for a number of scientific and industrial applications, including agriculture, hydrology, and forestry.

It has two sensors that capture nine different wavelengths of light, ranging from UV to infrared. While most of Land-



sat 8's data is displayed in the visible spectrum (i.e. what we can see), it also maps vital non-visible information that, when rendered using special imaging techniques, can reveal geological properties, such as hidden mineral deposits.

During the recent Covid-19 lockdowns, Seymour spent months poring over Landsat 8's images of some of the world's most remote locales (including north-west Australia, Namibia, Northern Chad, and South Sudan), which are publicly accessible via an archival tool on the USGS website. Then, by stitching together multiple photos and harnessing false-color image processing techniques—which help enhance features and textures that would otherwise be invisible to the naked eye—he reimagined black-and-white satellite data as brightly hued works of art.

“What’s nice about *Landsat Works* compared with my previous projects is that it’s a process of discovery. When I downloaded the raw images from the USGS website and combined them into the different RGB channels in Photoshop, I almost had no idea what to expect,” Seymour explains. “For me, the most fascinating thing about these almost

Romantic or Expressionist images is that they are also scientific documents that can be used to understand more about the geology of a place.”

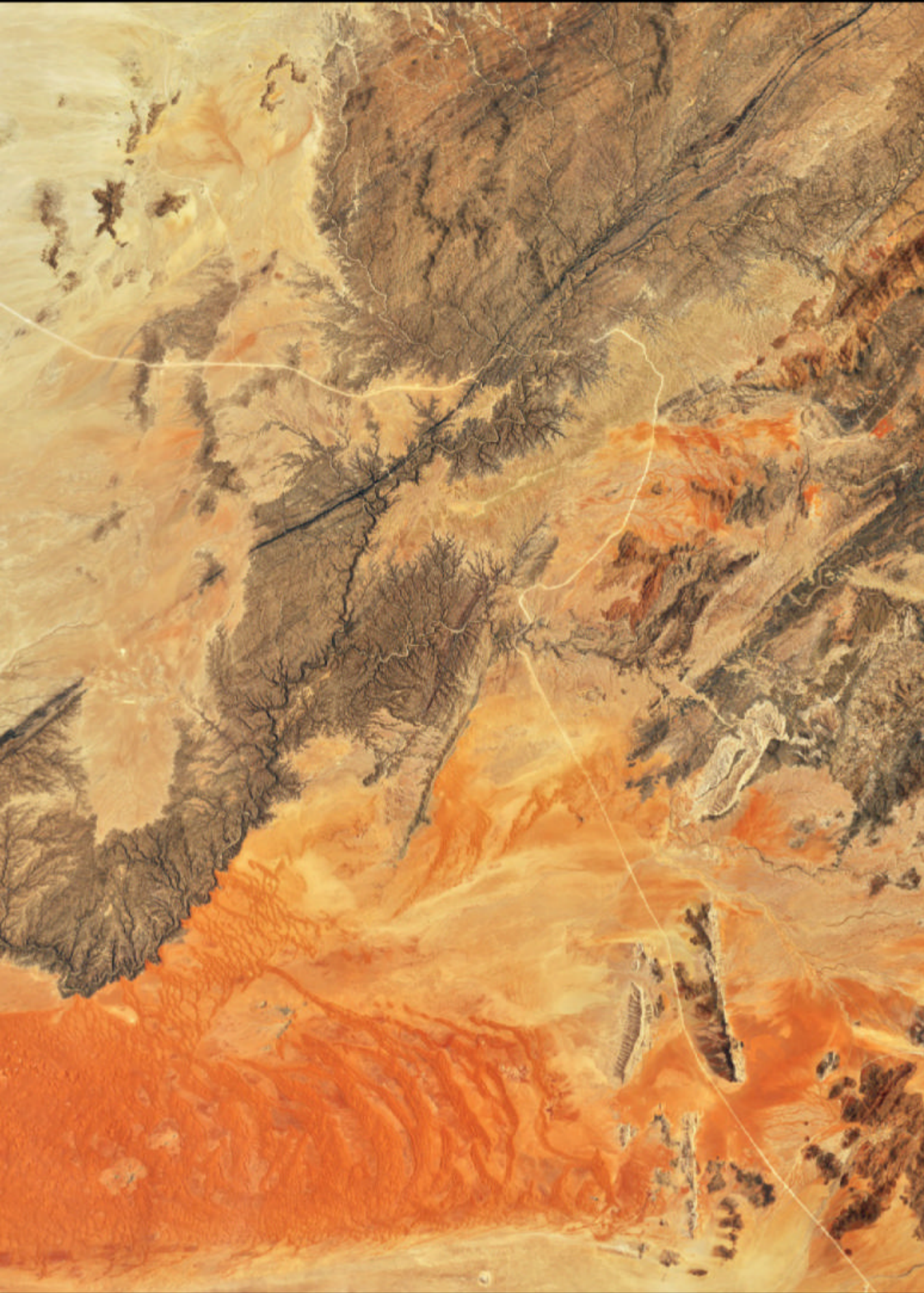
On one hand, these expansive artworks shine a spotlight on the role of surveillance in society today, as well as the omni-



↑
Landsat 8 orbits 705 km above the Earth, and captures in excess of 700 scenes per day.



Besides Landsat 8, Earth is surrounded by many planet-facing observing satellites.



Landsat 8 captured this image of the Namib Sand Sea, where it meets the Kuiseb River.



presence of the technological gaze. After all, as Seymour observes, satellite imagery is “a technological way of looking at the world that helps us to understand it”.

However, as with many of Seymour’s previous projects, *Landsat Works* also celebrates the sheer beauty of nature—and the urgent need to preserve it at all costs. The false-color image processing techniques that Seymour used were actually co-opted from the mineral prospecting industry—and, in this vein, *Landsat Works* highlights how surveillance technology is often harnessed to manipulate and exploit the environment.

“With *Landsat Works*, it’s about first revealing this invisible layer of information that technology can tell us about our planet, and then grabbing people’s attention and intriguing them with these brightly colored tapestries,” Seymour says. “Thereafter, hopefully they’ll understand the increasing role that technology plays in our environment, and the positive and negative implications of that.” richardjohnseymour.com

DELLE CHAN is a London-based writer and editor, and a regular contributor.

Extreme E, the FIA-sanctioned international all-electric off-road racing series, has, with appropriate speed, come a long way since it started as a glint in the eye of Formula E founder Alejandro Agag and former Brazilian driver Gil de Ferran in 2018. The races, inaugurated in April 2021, not only promote gender equality—each team must field both a male and female driver—and powers its cars with hydrogen fuel generated from off-grid water and solar energy, also maintain a “Legacy Program” to provide social and environmental support in the race locations long after the 10 teams, which include squads helmed by Nico Rosberg, Jenson Button, and Lewis Hamilton, have driven away.

One of the more niche eco-collaborations in the Extreme E world, however, comes from tire-maker Continental and official timekeeping partner Zenith. Due to its off-road nature, the tires in Extreme E take quite the pounding. The 550 hp, 1.78-ton SUVs are driven at their performance limit over harsh terrain for each 16 km race. The CrossContact off-road tires need a modified tread and an adapted rubber compound to reinforce robustness.

Despite the physical stresses of the competition, each Extreme E team receives only six new tires for each race weekend. As a result, there is not a huge amount of tire wastage, but still there was demand to try and do something with the discarded rubber. So, Zenith has repurposed Extreme E’s used tires to produce limited edition

watches based on its DEFY Extreme Carbon timepiece. These Extreme E versions (there are now three iterations, the latest being the Extreme E Copper X Prix, each limited to just 20 pieces) have components hewed from the depleted race tires.



↓
Zenith’s DEFY Extreme E Desert X Prix watch (\$27,000) uses old car tires as a strap material.

↓↓
In February 2022, the Extreme E race went to Neom, the site of a “smart city” in Saudi Arabia.

TREADING A NEW PATH FOR OLD MATERIALS

Truly befitting the circular economy, spent rally tires are getting a luxurious upgrade

Supporting Extreme E’s central message of sustainability, the watches’ Velcro rubber strap is made from CrossContact tires used during the first season’s races. Julien Tornare, Zenith CEO, tells WIRED that it took numerous prototypes to get the repurposed rubber to an acceptable aesthetic, but once achieved, they decided to go all in and deliver each watch in a waterproof and crush-proof case, also made from race-recycled materials, including the case’s lid coating fashioned from recycled E-grip tires, and the plate covering from sections of racing tarpaulin.

In the meantime, other institutions are working on more innovative solutions to tackle the estimated 1.8 billion end-of-life tires disposed of each year (comprising around 2 to 3 percent of all waste materials collected worldwide.) The Brook

Research Group at Canada’s McMaster University, for example, has discovered a process using silicone chemistry to break the sulfur-to-sulfur bonds that hold tires together. The oils recovered from the used tires were so similar to the virgin polymers used in tire production that the team has already managed to create new rubber tires—albeit miniature ones for toy cars.

JEREMY WHITE is WIRED innovation editor.



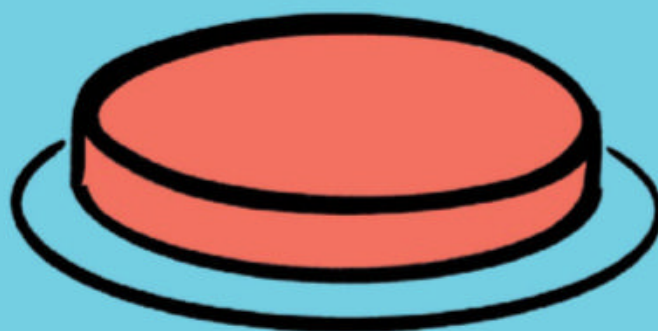
WIRED Smarter

Talks by:
Tim Berners-Lee
Werner Vogels
Parisa Tabriz
Sheela Subramanian

Conversations with:
Sharmadean Reid
Helen Tupper
& Sarah Ellis
Herman Narula

2022

WELCOME TO THE SMART RESET



WIRED Smarter takes the pulse of the worlds of work, research, the startup scene, and investor interest, with keynotes from figures including Sir Tim Berners-Lee and Parisa Tabriz, and an expert-led drill down into Retail, Money, and Security to find out what's on the WIRED network's collective mind. Here's what we learned...

WIRED
Smarter.

Our approach to data is fundamentally broken, Tim Berners-Lee—the inventor of the world wide web and cofounder of Inrupt—told the room in an agenda-setting first session. Monopolies, surveillance capitalism and fake news benefit from exploiting us and our data, rather than empowering us, as he first dreamed the web would do.

“People are locked into platforms and systems we can’t control, the winner controls most data, the online economy exploits not benefits us, and we provide our data for so little in return,” he pointed out. “Companies claim they’re better than you at knowing what you want.”

Most of the data we put online is siloed on the servers of companies and used to sell us as an audience for targeted advertising, he said. It is possible to download and delete our online histories, but we still can’t move our data between services.

Inrupt, cofounded with cybersecurity entrepreneur John Bruce and cryptographer and privacy expert Bruce Schneier, aims to restore users’ rightful ownership of their data using a platform called Solid, kick-starting the true purpose of Web3—“a mid-course correction”, taking the web to where Berners-Lee and other early founders always wanted it to go in the first place.

This next step is held up by the fetishization of blockchain and the hijacking of the term Web3 by cryptocurrencies. “Blockchain is too slow, too expensive, too public,” he said. “And actually, it’s not Web 3.0-whatever-we-call-it.”



TIM BERNERS-LEE

Cofounder, Inrupt

The next web needs a better foundation

We have an opportunity to steer the web back to its creators’ original, secure, user-centric vision. But first, we must break the data monopolies



Solid allows people to keep all their personal data in their own data “pod”, located on a Solid server. The data owners, “not some big megacorp”, will control their health, financial and other records, and give out granular access as they see fit. They can grant individual apps permission to read and write to their pod, selecting which data they can see. When people stop using an app, they revoke its access, but the data remains on their pod.

This doesn’t just help users, Berners-Lee argued. “Every time a company puts out a new app, they build a custom backend database and start the process of collecting user data, and they do it over and over again. It means we fill out *a lot* of forms online.”

Solid is rolling out services in parts of Belgium, with EU oversight, as “this not only does exactly what GDPR wants, it actually does more. It answers the spirit, not just the explicit demands.”

Berners-Lee was challenged on how he planned to make money and how to drive uptake of Solid when millions of people are effectively locked into data silos already. The money, he said, they’d figure out in time. As for uptake?

“People belonged to AOL before the web,” he replied, to laughter. “Somehow, they got all the people using AOL to commit to this funny web thing. We’re not asking Facebook, ‘please stop’. We’re happy for all the different things to go on, just like AOL went on. If every year, 10,000 more people use it than the year before, then gradually it changes. That’s what happened with web 1.0.”

6.5 MILLION

The number of people living in Flanders in Belgium, all of whom now have access to a Solid Pod to store and control their personal data

To simulate is human, Amazon CTO Werner Vogels told the room—after all, we’ve been doing it since we could first use our imagination. Amazon customers, however, are “divinely discontent” according to his boss, Jeff Bezos. So Vogels’ job is to simulate ways to keep humans happy—and democratizing quantum computing is the latest step in his quest.

“Technology helps us see things that used to be hidden,” he explained. “But screens are 2D while our real world is 3D. A 3D model is worth 1,000 pictures—actually 129,600—but it’s computationally intensive, there is no standardized image format like PDF, and even though we have enormous computing power in the cloud, there’s many problems that can’t be solved in a reasonable time.”

In June, Vogels headed up the launch of the AWS Center for Quantum Networking in Pasadena, California, which focuses on basic science like building better qubits, and error-correction algorithms. It’s building on Amazon Braket, which offers developers access to quantum computers from the likes of IonQ, Oxford Quantum Circuits, Rigetti and D-Wave, as well as software tools and simulators.

Amazon has also been investing heavily in O3DE, an AAA-capable, cross-platform open-source game engine for real-time 3D development that provides developers with a modular foundation for building games and 3D simulations across a variety of applications, including robotics, digital twins, automotive and healthcare.

“Why do we simulate?” Vogels asked. “To overcome physical limitations, to simulate dangers you would not want to play around with, and to accelerate time or slow it down to inspect things.”



WERNER VOGELS

CTO and VP of Amazon

Simulation’s real impact

Computer models have transformed the physical world. New tools that let us simulate in responsive 3D will take this even further

For the City Council of Amsterdam during the pandemic, Vogels recalled, this meant running scenarios on how to keep people one-and-a-half meters apart while shopping during lockdown. Working with AWS sims allowed them to experiment with covering the city in flowerpots to measure its effect—a massive endeavor in real life, but easy in a simulation.

For Amazon, effective 3D simulations could mean anything from modeling how shoes would look on customers’ feet, or how lamps in their homes might work across an entire day, to allowing van drivers to map routes that missed low bridges, helping to design autonomous vehicles, or

practicing robot routes through new factory layouts, he explained.

“One problem that we’ve been simulating is how patient autonomous trucks are,” he admitted. “I’ve been in one of these trucks recently, making a left-hand turn. The trucks are worrying about doing things in the safest way. The biggest problem we have to simulate is the other idiots on the road, standing in front of you.”

Quantum computing, he said, might solve density functional theory to simulate the behavior of molecules, or the problem of creating fertilizer cheaply and safely through simulation. But would it ever be able to model for idiots on the road?

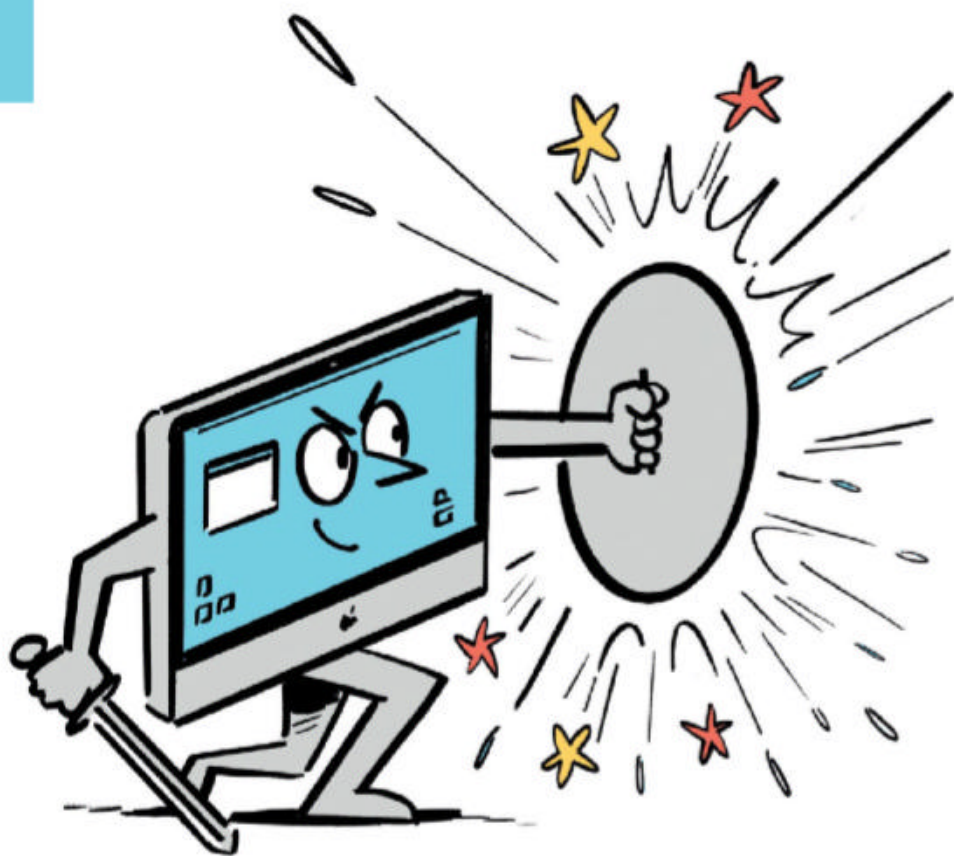


PARISA TABRIZ

VP/GM Chrome Browser & Google Security 'Princess'

Think like a hacker to stay cybersecure

The next level of cybersecurity will come from fresh mindsets. As well as thinking like a baddie, diversities of background and expertise will bring new perspectives—and greater safety



Cybersecurity incidents in Europe increased by a factor of ten over the past four years, Parisa Tabriz, vice president, Chrome Browser at Google warned the crowd, and on average, a company will fall victim to a ransomware attack every eleven seconds, costing the world some \$20 billion in 2021 alone. The answer, she told the audience, is to work with—and think like—hackers. “Our cybersecurity defenses and technologies have advanced quite a lot over the past 10 years,” the self-appointed “security princess” explained. This is in part thanks to Google’s vulnerability reward program, which pays hackers for finding and reporting flaws. In 2021, the program set a new record, with 696 researchers from 62 countries fixing 500 unique security bugs and paying out \$8.7 million in rewards.

“One of the cool things that I’ve seen with these programs is getting to know other hackers, some of whom choose to donate their reward to charity,” she beamed happily. As Google doubles charity donations, \$300,000 went to good causes thanks to hackers helping to fix Google’s products.



11 SECS

How frequently companies are falling victim to ransomware attacks. It cost them \$20bn in 2021

Why is this important? As an ex-hacker, she knew that to advance defenses, you have to think like a hacker. Her team, called Project Zero, focuses on attacks that exploit unknown vulnerabilities, or “zero day” attacks. Thinking like hackers would have helped a government agency she’d worked with that had banned email attachments in case they spread malware.

“The result was employees using personal Gmail and Dropbox accounts to handle and share sensitive data, and so you had a less secure outcome,” she shrugged. “And leaking government data, as we have seen play out, undermines trust in democratic processes and civil society.”

To protect vulnerable organizations—especially with Russian hackers battling for cyberspace dominance over Ukraine—her team has helped develop Project Shield, an anti-distributed-denial-of-service protection.

“We now defend more than 200 websites, including those that belong to the government, news, human rights groups and election monitoring sites in Ukraine, countries in Europe, and North America and Africa” she told the room. “Project Shield allows Google computers to absorb the traffic that is stemming from denial-of-service attacks, shielding smaller sites.”

Her three takeaways? First, keep working together, “because we’re increasingly connected, and advancing security is a cross functional, cross organization, cross border endeavor.”

Second, business leaders should tackle cybersecurity head-on and intentionally. “Always make sure that security is a key factor in how you’re assessing or reassessing the technology stacks you are building your business on.”

And finally, work towards a zero trust security model, constantly requiring verification for every person and device, and refusing to trust anything inside or outside a network.

The core approach isn’t just hacker thinking—it’s diverse thinking, she insisted. Her team includes graduates, dropouts, those with professional education in math or sciences, musicians, artists and historians. “And I’m finding people who studied psychology or law who are interested in security bringing new perspectives on trust boundaries,” she explained. “Real talent is everywhere, especially with security.”



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layers in the metaverse are wasting money and time on “bullshit”, Improbable’s CEO Herman Narula warned the room. Investors and developers need to avoid this confusion, or they’ll be at the wrong end of the next version of the dot.com bubble.

“If you define the metaverse in a way that includes smart TVs and Disney Glass, boy, are you going to be confused in what you invest in and where you go,” he said to laughter. “The metaverse has nothing to do with technology or virtual 3D worlds in the same way a Kindle has nothing particularly to do with defining literature.”

Even virtual reality headsets are “Facebook’s poisonous distraction,” he shrugged. “When you play a game of *Fortnite* with 100 players, that takes 10,000 operations per second on the backend. When you use WhatsApp, that service is handling about a million messages a second. In order to hang out and talk with 30,000 people watching a cricket match in the metaverse, it’s billions of messages per second. But what’s interesting is the world itself. We should be talking about Narnia, but we’re discussing the wardrobe.”

Founded in 2012, Improbable provides software to support large-scale online multiplayer games and, in 2022, raised \$150m to launch its blockchain-based M² platform, supporting a network of interoperable metaverses and allowing people to transfer appropriate value between those worlds.

He admitted it was easier to say what the metaverse wasn’t than define what it was. “It’s a network of meaningful identities, objects, events and experiences that connects different socially constructed realities,” he said. “Sport is a good example—value transfers from the world of sport to the real world. It’s a game where someone wins the World Cup, which fundamentally doesn’t matter—but its value in that world does transfer to the real world.”

Value in the metaverse can be as simple as the labor of death—“If you’ve played a free-to-play action game online, the reason it’s free to play is because your job is to die, while the people who have paid money have the opportunity to beat you,” he explained. “Your work creates value for the company.”

At this stage, however, fashion brands, sports leagues and music labels are ahead of gaming companies in their understanding, “because the idea of taking your LVMH handbag into a football match makes sense, while the idea of bringing a machine gun into Hogwarts makes little sense,” he explained. “The metaverse is about related incorruptible content, a tapestry of meaning. You can’t just willy-nilly mash things

together any more than you can mash religions together in the real world and expect them to get along.”

His advice to a brand or company is to start with one event or experience, see how your community interacts with you and with each other, then think about how to turn it into a conversation. Think like a sports brand rather than a gaming company, because “human experience is already a collection of the real world, thousands of ideas, other worlds and experiences,” he said.

“It’s not a question of whether we need the metaverse—we have always embraced this idea,” he concluded. “The inner experience of our minds has so much more to offer us than we ever really accept.”

HERMAN NARULA

CEO and cofounder, Improbable

The metaverse isn’t what you think it is

The biggest technological, social and commercial shift in decades still has most of us scratching our heads. We need to focus on connection



150M

Dollars raised by Improbable to launch M², a system for moving assets between metaverses

**SHARMADEAN REID***Founder, the Stack World***HELEN TUPPER
& SARAH ELLIS***Cofounders of Amazing If***SHEELA SUBRAMANIAN***Vice president, Future Forum at Slack*

After another tumultuous year, our speakers had plenty of fresh takes on how workers have gained a whole new perspective on what it means to be an employee—and what companies need to do to if they want to survive and thrive in this new landscape

Helping employees with squiggly careers could

Helping employees with squiggly careers could enable companies to overcome the labor shortage challenging much of the West, explained an array of expert speakers. Sharmadean Reid, founder of the Stack World, Helen Tupper and Sarah Ellis, cofounders of Amazing If, and Sheela Subramanian, vice president, Future Forum at Slack all warned that, if the workplace doesn't change, employers face losing up to 60 percent of staff.

"This is a global trend that's impacting all of our workplaces," Subramanian warned. During lockdown, she said, "employees were redesigning their lives, their priorities, their time—and they weren't necessarily seeing that reflected in how they worked."

Don't buy people off, Tupper added. "Not having opportunities to grow and develop in your career is why people look to leave. We've got to re-imagine retention—or as we would describe it, we've got to help people to squiggle and stay."

Squiggly careers, Ellis explained, avoid the old-fashioned "ladder" idea of career development—"We all start at the bottom and work our way up through a series of steps that are predictable and linear, all motivated by the same thing"—in favor of moving frequently and fluidly between roles, industries and locations. This can feel stressful, but with support, it can be full of opportunity and purpose.

Millennial women are at the heart of the movement for flexibility, Reid told the room. The 10,000-strong Stack World community were "quiet quitting, because they were grieving a vision for their future that'd been sold to them," she explained. "I'm very much of the generation who was told I could have it all. Just lean in, be a girl boss, you can do everything. You can buy that house, you can get to the C Suite, and actually, what the pandemic did was put a halt on our dreams."

Older workers may not understand. Indeed, Reid quoted one Gen X male on Stack World who posted: "Thank you to all your quiet quitters. You make it easier for the rest of us to get promoted."

"That is actually quite terrifying," Reid pointed out. "Because right now we still have such a massive, massive gap in leadership, and hybrid working means women are not in the room. How do we avoid a future gender leadership gap, if only 8 percent of Fortune 500 CEOs are women, and there's a whole bunch of people who are quiet quitting?"

Smarter employers are removing the barriers to employees trying out different things to make the most of their talents, Tupper and Ellis explained. They advocated "career safaris"—giving people "a holiday from their day job to spend time with other teams, in other places, to get an understanding and test their assumptions with no expectations that they have to go and do that job."

Leaders need to think digital-first, not office-first, shift from C Suite-centric to employee-centric, and say "do as I say" less often than "I need your feedback", Subramanian suggested. "I get the reaction, 'I need my team to come together synchronously, I can't have people working whenever they want'," she recalled. "But two thirds of those that we've surveyed say they want flexibility and a framework, meaning core team work hours in a given day, where your team comes together to do one-on-ones, team meetings, collaborate. Then let people do their focus work when that works best for them."

If leaders don't take on a more experimental mindset, all the speakers warned, we face burnout and quitting. But if they do embrace experimentation, the possibilities are infinite.





Community = customer connection

You can't be part of a community if you don't understand them, Sujata Bhatia, chief operating officer, Monzo, warned, and a brand's tone of voice is critical. "It's not just about customer experience—it's about customer connection. It needs to be your north star," she explained. "People can smell fake—but if you're serious, it can be truly transformative."

Blockchain is more than crypto

"A lot of people think blockchain is just crypto and bitcoin," said Lavinia Osbourne, host and founder of Women in Blockchain Talks. "But blockchain can be a tool to address long term problems around equity, gender, and supply chain." The key thing about blockchain is its decentralization, she argued. "No one can say, 'you're not a traditional finance company, you can't come in.' And so they are coming in."

Invest with your friends

Social investing startups can help people with the cost-of-living crisis because they're on the same level in the relationship, not top-down like older companies, suggested Harjas Singh, CPO at Shares. "The first point is: Do people even understand that the current economic market is bad for them? Then it's about introducing them to healthy investment goals."

Helping with carbon savings

Banks can help people understand their carbon footprint and make effective changes, Cogo CEO Emma Kisby explained. Cogo's app measures carbon footprint by integrating with banking apps. It can spot, say, an energy bill payment and suggest a renewable energy alternative. "Wherever somebody has spent money on something that has a lower footprint, we reward them," she explained.

Crypto could be stabilized

Can anyone save crypto? Whenever you have innovation, you should allow for failures, according to Jonathan Farnell, general manager UK, Binance, the world's largest cryptocurrency exchange. Binance and other large exchanges are becoming lenders of last resort, bailing out and centralizing the industry, hopefully securing its future.

Sterling dips into digital

The Bank of England is moving one step closer to launching a central bank digital currency to sit alongside cash, Louise Eggett, Head of the Fintech Hub, Bank of England, announced. It means consumers could hold deposits at the Bank of England—currently only open to financial institutions—and use a state-backed alternative to cryptocurrency that won't fluctuate wildly, but remain equal to its physical counterpart.

Social trading's stock rise

Social trading is disrupting investing, and the meme stock rally made everyone take note of the collective power of the retail investor, argued Heloise Greeff, eToro influencer. "Today, the retail investor has access to more information than a hedge fund had ten years ago," she added.

smart tips from the Money stage



7 ideas we bought into at Retail

Seed access is crucial

The cost of entry to retail startups is holding back DNI, warned Abi Oyepitan, cofounder of LIHA Beauty. “We were told ‘you could get your first £50k from friends and family,’” she laughed. She found investors were surprised when she said her friends and family didn’t have a spare £50k. “It’s not just a race thing; it’s a class thing.”

Ecommerce should get personal

Thirty-seven percent of fashion executives cite social commerce as one of the top three themes that will impact their business in 2022, and by 2025, ecommerce is going to be the largest and primary distribution channel for luxury goods, according to Ommy Akhe, creative technologist at autonommy —so the experience needs to be more personal.

Diverse markets are huge

The beauty industry is wasting money idealizing white women with straight blonde hair when there’s far more money to be made in diverse products, Rachael Twumasi-Corson, CEO and cofounder at Afrorenchix pointed out. Blondes are less than 10 percent of the planet. “Curly dark hair is more common, even in white people,” she explained. “If you’re looking at diversity and inclusion, take the most neglected category in beauty, develop products that work well for them, and you’ll find you’re cooking for everyone.”

Don’t neglect offline retail spaces

“Ecommerce pushed forward ten years in fifteen months during the pandemic,” Deann Evans, director of EMEA expansion and partnerships at Shopify told the crowd. And, while coming out of the pandemic has seen offline soar in popularity, brands still need to re-imagine the physical store.

Don’t let Web3 distract you

Web3 isn’t cool, according to Sandrine Deveaux, executive vice president, Future Retail at Farfetch. Barely one percent of the world uses cryptocurrencies, but every shopper loves walking into a store and having the staff know your name. “Focus on technology for the sales associate, not NFTs,” she argued. “That’s critical for luxury brands, so that a VIP in the store in London gets recognized when they visit in New York.”

Fitness is shaping up

“The next big retail opportunity is around fitness,” Deveaux concluded. New models have emerged—like Peleton—which have slowed or crashed, but the gyms are not connecting customer data with any digital proposition. It’s an industry ripe for disruption within the next couple of years

Embrace authenticity

Social commerce is redefining the future of retail, according to Patrick Nommensen, senior director of ecommerce at TikTok. Mobile creators, short-form video, live streaming, and community can let brands access new audiences based on authenticity and trust, he explained.

37

Percentage of fashion executives who cite social commerce as a key theme for 2023



Be aware of your tech's true agenda

"Technology encodes standards, and standards encode values—so whoever writes your technology imposes *their* values," Dr Ian Levy, technical director of the NCSC told the room. Technology should encode democracy, but standards and technology are currently being used for Great Power competition between East and West.

Pushing for privacy as standard

A real-life version of Google would be someone who follows you around wherever you go, monitoring your every move, anything you say, everyone you meet, and everything you buy, pointed out Andy Yen, CEO of Proton. "In real life, we would never allow this, but because it's invisible, we accept it—even though more of our lives are online." Users, however, are waking up to this—and companies are finally talking seriously about privacy.

Deep fakes will be a real problem

By 2025, at least 90 percent of online video content will be generated synthetically, predicted Nina Schick, author of *Deep Fakes*. "To the human eye, it is impossible to distinguish between real and AI-generated synthetic content—and the AI itself may not be able to do so," she warned.



7 things we unlocked from Security

Privacy united with national security

The Splinternet is already here, added Andy Yen, who pointed out that nation states are controlling information, while consumers are finally caring about privacy. They seem to be at odds, but privacy and national security, he explained, should not be opposing forces, but two sides of the same coin.

Secure your software

In cybersecurity, we are treating the symptoms, not the cause, claimed Ian Levy. We blame Russians for a hack, but we should also look at the incentives for the private equity owners of software companies to invest in the resources needed to create secure software. "Your technology supply chains are unknowable, so you should trust no one," he said.

Crypto isn't really anonymous

It's actually much easier to trace money laundering on the blockchain than it is with traditional finance, Simone Maini, CEO, Elliptic explained as she "followed the money" in a case study on how the ransomware Conti Syndicate were tracked and cracked down on, thanks to its reliance on crypto.

Getting ahead of the hack

Cybercriminals are getting smarter and quicker at retooling their tactics, and the increase of blurring between cyber-crime and nation-state actors means companies should not separate the two warned Raj Samani, chief scientist at cybersecurity firm Rapid7. Companies need to stay aware of the cybersecurity trends so that they can be as proactive as possible in protecting their information.

90

The percentage of online video content that will, by 2025, have been created by an AI, as predicted by Nina Schick



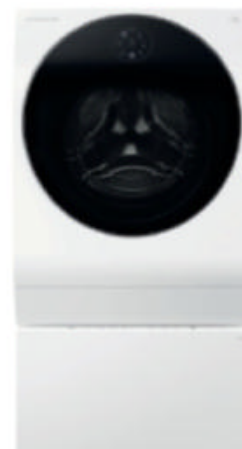
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*Based on internal test by GP of the fastest NiMH battery chargers by leading NiMH battery charger brands available in major global markets as of May 2021. Test conditions:
Average time required during 5 simultaneous charges of 4pcs of new Charge 10 1700mAh AA batteries to 90%+ of capacity at 20°C followed by battery discharge according to IEC 61951-2.





Edited by **Jeremy White**



Photography **Sun Lee**

Words **Chris Haslam**

Teenage Engineering PO-80 Record Factory ▲

Made in collaboration with Japanese designer Yuri Suzuki, this monophonic turntable might look like a child's toy, but it is in fact capable of cutting your own lo-fi vinyl records, and playing them back to you. USB powered and supplied with six black 5-inch blank records, you can cut any digital recording (4 minutes per side at 33 rpm, 3 minutes at 45 rpm) via the 3.5mm audio input. Teenage Engineering has also created an online mastering tool, to help make your opus sound as good as possible. Although please, before dropping the needle, temper any audiophile expectations. £149 teenage.engineering

Refill blank records are available in £20 packs of 10; 5x black and 5x white vinyl.

MUSIC!



1. Boombocs STUDIO

Boombocs founder Jonny Williams is known for his briefcase-sized Bluetooth speakers, but his latest, the STUDIO, is a compact must-have. Coming in a range of retro hues, it packs in 15 hours of power, Wi-Fi connectivity, app control, and access to Spotify, Deezer and Amazon Music. It's old skool meets digital, with a price that's more 2010 than 2023. £130 boombocs.com

2. Roland AIRA Compact Series

Roland's beloved '80s-era instruments are getting a second life as affordable and extra-portable reissues. The AIRA Compact line includes a 303-style drum machine, a JUNO-style sequencer, and a Kraftwerk-tastic vocal processor. They're all Midi-capable, with two 3.5-mm ports for daisy-chaining, and even have mix-in/mix-out ports, too. \$200 roland.com

3. JBL Tune Flex Ghost

Supplied in a tiny, pocket-friendly case, these have a combined battery life of 32 hours, solid ANC and decent 12mm drivers. You can also switch between snug-fitting noise isolation silicone tips, or opt for a more open, Apple AirPods-style tip, that rests just outside the ear. Yes, the audio isn't top-of-the-line, but they're a capable pair of beaters for a great price. £90 jbl.com

4. Grado Prestige SR60x

Each pair of Grado headphones are hand-assembled in Brooklyn, New York—so it's quite remarkable that these ones cost only a smidge over £100. The entry-level option in its Prestige series, the 44mm drivers, open-backed sound, on-ear comfort and classic build quality make these wired cans expressive, refined—and an absolute steal. £110 grado.co.uk



**Andertons EastCoast
T1 Guitar Starter Pack** ◀

Channel your inner Keith Richards with this bargain all-in-one electric guitar bundle with an amp, guitar stand, cable, gig bag, digital tuner and a pile of picks. The EastCoast T1 (£119) is a fantastically well regarded entry-level axe that punches well above its weight with its solid Poplar body that offers plenty of tone without being too heavy. The maple neck, topped with a 12-inch radius Maple fingerboard, feels incredibly comfortable, too. The Fender-style 15W Eastcoast amplifier (£59), is ideal for practicing, and with multiple volume controls, gain and reverb, it's easy to play it clean or get it growling.

£179 andertons.co.uk

IKEA VÄRLDENS Travel Tote Bag ▼

GEAR

While the legendary blue FRAKTA shopping sack will always be our favorite carry-all, this 16-liter bag from in-house IKEA designer Jonas Hultqvist puts many a high-performance fashion tote to shame. Inside, it's sensibly compartmentalized, including a padded slot for laptops and a removable key-clip, while outside are two yellow-lined open-front pockets, and a larger one with a zipper. Carry as a tote, a messenger, or a backpack. £27 [ikea.com](https://www.ikea.com)



FASHION!



**1. Forclaz MT900
-18°C Jacket**

Forclaz is Decathlon's premium collection, blending high-end performance with brilliant value.

This jacket uses responsibly sourced down and feathers, and has pit vents for dumping heat quickly, plus waterproof panels on the cuff, shoulders, and hood.

£109 decathlon.co.uk

**2: UNIQLO
HEATTECH Gaiter**

Call it a neck, a snood, a buff or a gaiter—there's not many better, or cheaper ways to keep the chill off. This waffle-knit design benefits from the warmth-without-weight brilliance of UNIQLO's HEATTECH fabrics, and can also be worn as a beanie or a headband.

£12.90 uniqlo.com

**3: Wildhorn Pipeline
Goggles**

Skiing isn't a pursuit for penny pinchers, but you can shop cleverly and still look posh on-piste. Wildhorn's Pipeline goggles combine premium looks, a comfy fit, a wide field of vision and superb optics. You can even swap out the lenses for just \$35 a pop.

\$99 wildhornoutfitters.com

**4. Pilo 2 Fabric
Shaver**

This palm-sized Scandi-style sweater saver will revitalize bobbly knitwear and home textiles. Six blades spin at 9,000 rpm (mercifully shielded from curious fingertips), which provides a much larger shaving area than similar alternatives.

£55 steamery.co.uk



**5. Philips Sneaker
Cleaner**

This dedicated sneaker cleaner from Philips can keep your high tops box fresh for that bit longer. With a little soap and water, the three oscillating brushes (soft for mesh and canvas, spongy for PVC, leather and suede, firm for soles) will make quick work of the most caked-on kicks.

£30 philips.co.uk

6. Nike GPS

Please do join us on the waiting list for Nike's General Purpose Shoe. Designed by sculptor Tom Sachs as the ideal everyday sneaker, they feature a clean mesh base with suede overlays. The intention was to be affordable, durable, and versatile—but thanks to sneaker pimps, they're also (for now) unattainable.

\$110 nikecraft.com



1. Apple AirTag

Ideal for forgetful iOS users, these bottle-cap-sized trackers connect instantly to your iPhone. Once you've attached one to your item, it makes it very difficult to lose, as it taps into the 1.65 billion Apple devices in the world to help you pinpoint its location. From £29 (£99 for four) apple.com

2. Cast Jewelry Making Kit

This DIY jewelry kit lets you design your own solid silver ring. Use the tools to carve the blank wax shapes into your dream bling, then send it back to Cast who will make the real thing in silver (or gold or platinum for a premium). From £89, experiencecast.com

3. Lomography Fisheye Baby 110

This weeny 7cm-wide fisheye film camera takes round images using tiny 110mm film cartridges. It's cheap, leaky, creaky and utterly analog—but you won't have as much fun with a pricey digital, and every shot is a surprise. \$34.90 lomography.com

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GIFTS!

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4. GoalZero Nomad 10

The very definition of a gift that keeps on giving, this compact and foldable solar panel will happily charge pretty much anything you plug in. The USB port can serve 5V of juice (up to 1.5A) and you'll be genuinely impressed by how fast it can top your toys up. \$99 goalzero.com

5. MSR Steel Stake Hammer

Thor meets *Tron* in this sexy—yes, sexy—camping hammer of the future. At 312g it's light, and is far better at securing tent pegs than a rock, your foot, or a trad rubber mallet. Made from hardened stainless steel, it even has a bottle opener. Hammer time! £29 msrgear.com

6. LEGO Space Mission Classic Box

Yes, mega-franchise LEGO sets are cool, but they're rarely rebuilt. Try the endless play (and value) of a huge box of bits—this space-themed set has plans for simple mini-builds, but with 1,700 pieces, there's lots of leftovers for freestyling fun. £70 lego.com

7. POTR Ocean Pot

These stylish flat-packed plant pots are the latest welcome addition to the plethora of products made from reclaimed ocean plastic. POTR uses fishing-net waste washing up on Scotland's west coast to create origami-style pots that use 100 times less carbon than typical pots. From £16 potrpots.com



Time To Go NATO ◀

We know what you're thinking: how can a Rolex or a Grand Seiko possibly qualify for this selection of low-cost, high-value items? It's all in the straps... From as little as £8 you can give an £8,000 timepiece some fresh style chops, effectively getting a new watch to show off. Watch obsessives twigged this budget hack a while ago, and so online strap sellers are doing big business. Crown & Buckle, based in the US, offer a large selection that includes this *#Straps4ACure* option (\$28.90) on the Rolex. Meanwhile, the UK's Nato Strap Company has a quality lineup including the others you see here, with the Seatbelt Porto in grey (£20) setting off the Grand Seiko "White Birch" dial beautifully. *crownandbuckle.com; natostrapcompany.co.uk; Grand Seiko Hi-Beat White Birch, £8,500 seikoboutique.co.uk; Rolex Submariner, £7,500 rolex.com*

KITCHEN!



1

1. Rowlett Regent Four Slice Toaster

A British-designed commercial-grade toaster for the crumpet lover in your life, this appliance can also save you money. For one thing, Rowlett sells replacement parts, so it's fully repairable. And, you can fire up only the slots you're using, so there's no wasted energy.

£135 nisbets.co.uk

2. Joseph Joseph Rota Sharpener

With a choice of coarse and fine grinding-blades, this ergonomic knife sharpener can revitalize even the bluntest tools. To use, the top cover opens out wide and clips in place to be used as a sturdy handle, and once you're done, it folds away neatly.

£20 johnlewis.com

3. AeroPress

Launched in 2005, the AeroPress remains one of the fastest, and most effective ways to make a single cup of proper coffee. Combining drip and pour-over principles with a fine paper filter, it's inexpensive, easy to maintain, idiot-proof, and comes with a year's supply of filters.

£37 aeropress.co.uk



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4. Global G-26115 3 Piece Knife Set

Global knives have an iconic 90s style, and a cult following among foodies—but they're not out of reach. Around the holidays and Black Friday sales, they often get hefty discounts—especially the gift packs like this one, which features a 20.5cm Cook's knife, a 16cm bread knife, and an 8cm peeling knife. £149 kitchenknives.co.uk

5. Falcon Enamelware Bake Set

Founded in the 1920s and reborn in 2011, Falcon Enamelware conjures up nostalgic images of home cooking done Grandma's way. Porcelain fused onto heavy-gauge steel makes for exceptionally robust kitchenware that'll last for decades, survive dishwashers, and will also age gracefully. £85 falconenamelware.com

6. Bosch ErgoMixx 1000 W

Hand blenders are kitchen must-haves, but this 12-speed design from Bosch has an extra trick—it can use a vacuum pump attachment to suck the air out of specially designed zip-lock bags and food containers. This greatly improves the quality and longevity of any leftovers, helping to reduce food waste. £99 bosch-home.com



5



6



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Consulting@wired.co.uk

1. Sproos Shower

Designed to slot over a standard 45° spout, this shower system can upgrade a bathroom without the demolition work—perfect for renters. It comes in red, black or yellow, while rack options include cup holders and iPhone mounts.

From \$199 sproos.co

2. Victorinox Nail Clippers

Small, light (12g) and phenomenally sharp, these stainless steel nail clippers look stylish and work brilliantly. Our neglected and gnarled nails didn't stand a chance against the power of Victorinox.

£12 victorinox.com

3. Beauty Pie

Beauty Pie is famous for its great-value monthly boxes, but you can also buy its top-notch best-sellers, like the Japanfusion Genius Lift Elixir, which gives skin a glowing boost—without draining your bank account.

£40 beautypie.com

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BATHROOM!

3



4



GEAR MONEY SAVING SPECIAL

5



OFFICE!

6



7



4. Ultimate Ears Wonderboom 3

Being IP67 rated, the Wonderboom 3 Bluetooth speaker can take a 30-meter dunking for 30 minutes—so it'll definitely survive your bathroom. It's also great for go-anywhere audio, with a 22-hour battery. And it floats! £89

ultimateears.com

5. OHTO Smile Clip

Saying the words “paperwork” and “adorable” in the same sentence? Now you can, with these tiny clips of unbridled joy. Designed (of course) in Japan, each jolly, powder coated 13 x 10mm metal clip can hold up to 25 sheets of 80gsm paper.

£0.25 cultpens.com

6. Kaweco 060 Pen

Kaweco's 1930s Sport line of chunky hexagonal pens are a design classic. The chic new all-black “Original” line is based on the Sport, but with a solid aluminum body and scratch-resistant anodization. €89 is a bargain for this level of quality, and it will last forever.

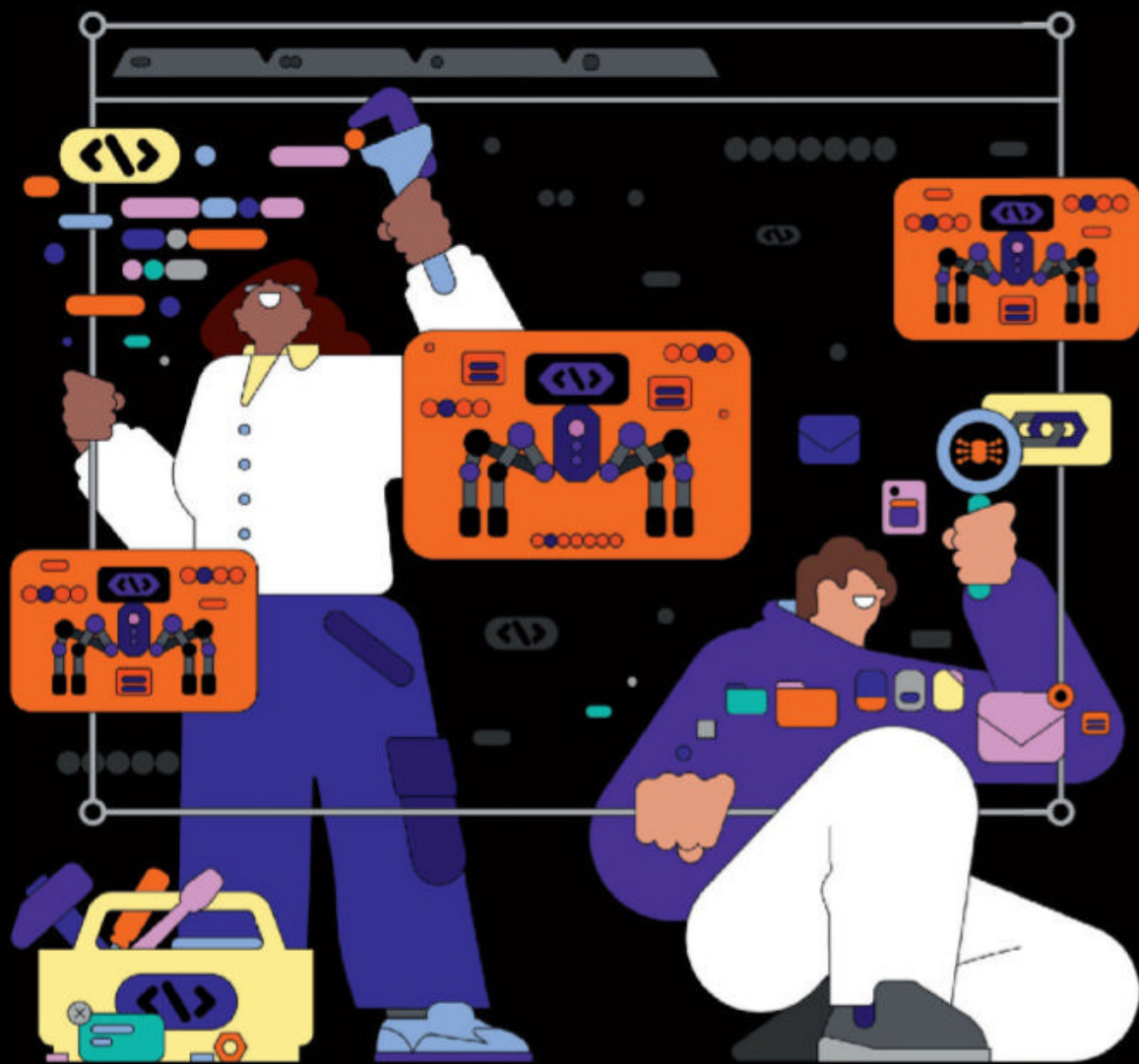
€89 kaweco-pen.com

7. Rotolight Ultimate Vlogging Kit

This all-in-one ring light, phone mount, and mini desktop-tripod will boost your on-camera game, softening the light, banishing shadows and, with the skin tone and color filters, create the impression of a healthy glow.

£66.65 rotolight.com

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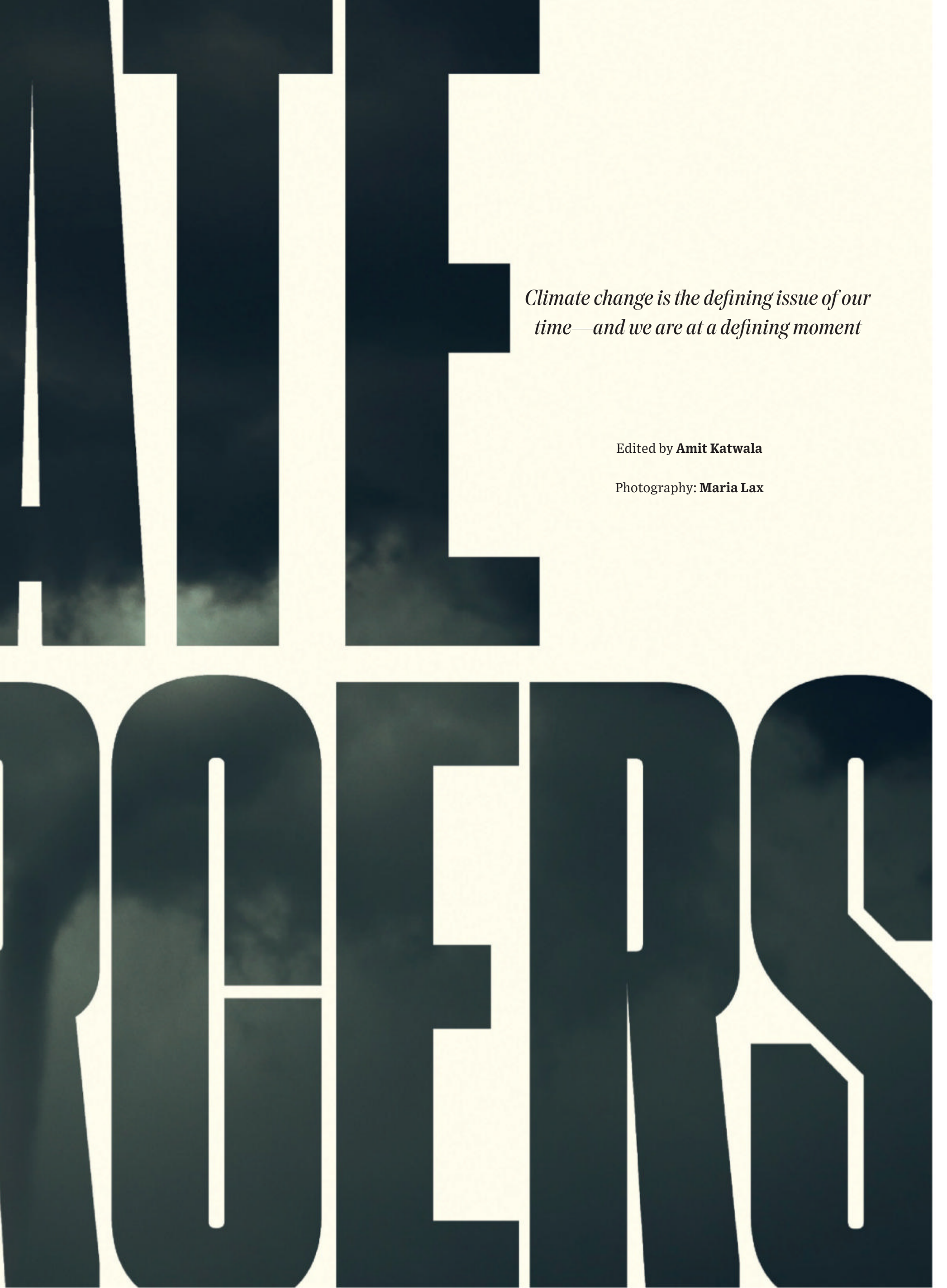


TILE DESIGN BY STUDIO GDB; PHOTOGRAPH BY ABEL MINNÉE



BELOW

FOR



*Climate change is the defining issue of our
time—and we are at a defining moment*

Edited by **Amit Katwala**

Photography: **Maria Lax**



Friederike Otto and her small team are finding ways to attribute the impact of climate change to extreme weather events around the world, in an effort to dispel climate deniers with hard evidence.



FRIEDERIKE OTTO *ATTRIBUTION SCIENCE IS THE SMOKING GUN FOR CLIMATE CHANGE*

On July 19, 2022, the UK experienced a taste of the weather to come. Temperatures reached 40.3 degrees Celsius—soaring past the previous record by more than one-and-a-half degrees.

Dozens of homes in east London were destroyed by fires, while elsewhere in the country, the heat pushed the power grid close to the point of failure. The Office for National Statistics estimates that there were more than 2,800 excess deaths among the over-65s during the summer heat waves of 2022, making it the deadliest year for heat since 2003.

Before the temperatures had even peaked, Friederike Otto was in her office in Imperial College London, getting ready to answer the question that she knew would be thrown at her countless times in the following week: Was climate change to blame?

When an extreme weather event strikes, Otto and her small team of climate scientists—most of them working in their spare time—are the people the world looks to tell them if climate change has made the weather more severe or more likely to be. “I think it’s important to get a more realistic picture of what climate change means,” says Otto, a senior lecturer in climate

science at The Grantham Institute for Climate Change and the cofounder of the World Weather Attribution initiative. “For some types of events, like heat waves, climate change is a real game-changer, and we see events that we have never seen before.”

Every week, a contact at the Red Cross sends Otto and her colleagues at World Weather Attribution a list of floods, heat waves and other extreme weather events across the globe. Often there are six or eight crises listed in the email—far too many for Otto’s small team to tackle—so the scientists narrow their focus to weather that is impacting millions of people, selecting roughly one event every six weeks, from storms in Europe to flooding in Pakistan.

Once the scientists have picked a subject for their analysis, they move fast, digging into historical records and running climate models in order to figure out what role—if any—climate change played in a disaster. The final report is usually published within days or weeks of an extreme weather event. This is a huge departure from the normally glacial pace of academic publishing, where it can take years for a scientific paper to finally end up in a journal, but quick answers are the whole point of World Weather Attribution. By releasing studies while an extreme event is still dominating headlines and political agendas, the scientists fill a void that might otherwise be occupied by climate change denial. In the case of the UK heat wave, World Weather Attribution was ready with its report just nine days after temperatures reached their peak.

The findings revealed the unprece-

dent scale of the record-breaking temperatures. Otto’s team estimated that climate change had made the UK heat wave at least ten times more likely and that in a world without global warming, peak temperatures would have been about two degrees Celsius lower. The weather was so unusual that, in a world without climate change, it would have been statistically impossible to reach such high temperatures in two out of the three weather stations the scientists studied. In the world of climate attribution science, this is about as close as you get to a smoking gun. “People always want the number, and sometimes you can’t give a very satisfactory number,”

071

1. Friederike Otto

Climatologist & senior lecturer

Friederike Otto works as a senior lecturer at the Grantham Institute for Climate Change and the Environment at Imperial College London. Previously she was associate director of the Environmental Change Institute at the University of Oxford.

Otto says. This time, however, Otto had no shortage of numbers to share with the reporters who were ringing her up.

But attribution science can do a lot more than tell us how climate change influences the weather. Otto wants to use her attribution reports to hold polluters to account for extreme weather events. “We have started to do a lot of work with lawyers, to basically bridge this knowledge gap between what we can say scientifically and what has so far been used in terms of evidence,” she says. With legal cases underway in Germany and Brazil, attribution science is moving into the courtroom.

Otto cofounded World Weather Attribution in 2014 with the oceanographer Heidi Cullen and climatologist Geert Jan van Oldenborgh. At first, Otto—who has degrees in physics and philosophy—thought that the main role of weather attribution was to untangle the complexity of weather systems to quantify how much climate change was influencing extreme weather. Other scientists had established how to use climate models to attribute weather events to climate change, but no one had tried to use the science to produce rapid reports on recent disasters.

World Weather Attribution’s first real-time study was published in July 2015. It found that a heat wave in Europe earlier that month was almost certainly made more likely thanks to climate change. Other studies followed on floods, storms and rainfall, each one published within weeks of the disaster. But attribution studies aren’t just about understanding past events—they can help us prepare for the future, Otto says. “I see attribution now as a tool that helps us disentangle drivers of disasters and helps us use extreme events as a lens in society to see where we are vulnerable.”

Pakistan’s devastating 2022 monsoon season is one example of this. Otto and her colleagues agonized over the wording of their report, as there were so few similar events in the historical records, that their models struggled to simulate the extreme rainfall accurately. They knew that rainfall in the area was much more intense than in the past, but they couldn’t put a firm number on how much of that increase was due to climate change. “It could be that all of it

is climate change, but it could be that [the role of] climate change is much smaller,” Otto says. Even though the cause couldn’t be pinpointed, the report highlighted just how vulnerable Pakistan is to severe flooding, highlighting the proximity of farms and homes to flood plains, poor river management systems, and poverty as major risk factors. “Vulnerability is what makes the difference between an event having basically no impact or it being a catastrophe,” says Otto.

World Weather Attribution’s work tends to make headlines when it concludes that climate change makes extreme weather more likely, but the opposite result can be even more useful to regions facing disasters. One investigation into a long drought in southern Madagascar found that the chance of low rainfall hadn’t significantly increased due to human-induced climate change. Knowing this gives agency back to countries, says Otto. “If you think it’s all to do with climate change, then there’s nothing you can do unless the global community gets its act together. But if you know that climate change is not actually playing a big role, or none at all, then that means everything you do to reduce your vulnerability actually makes a huge difference.”

072

***‘CLIMATE CHANGE
WILL NEVER BE
A CATASTROPHE
FOR THOSE
WHO ARE RICH.’***

It’s not only governments that are extremely interested in the results of attribution studies. Courts are starting to pay attention, too. In August 2021, an Australian court ruled that the New South Wales Environment Protection Agency had not fulfilled its duty to protect the environment from climate change, in a case brought by bush fire survivors. One of Otto’s attribution studies into the 2019/20 bush fire season was used in a report commissioned by the court, but she only found out about it when one of the lawyers involved in the case emailed her after the verdict had been declared. “This is really nice to see, when a study that we did has real-world impact,” she says.

If attribution studies can tell us that a disaster was made more severe because of climate change, they also point towards something else: Who might be held responsible. Richard Heede, a geographer from California, has spent decades delving through archives to esti-

More than simply proving that climate change is causing extreme weather events, the attribution science being pioneered by Friederike Otto may also enable us to hold polluters to account.





The value of Friederike Otto's attribution work isn't just in identifying when climate change contributes to extreme weather, but also when it doesn't, meaning regions are better able to plan for the future.



‘IT’S IMPORTANT TO GET A MORE REALISTIC PICTURE OF WHAT CLIMATE CHANGE MEANS.’

climate companies’ carbon emissions all the way back to before the Industrial Revolution. The result is known as the Carbon Majors: a database of the world’s biggest polluters up to the present moment. The 2017 Carbon Majors report found that half of all industrial emissions since 1988 could be traced to just 25 corporate or state-owned entities. The state-owned fossil fuel firm Saudi Aramco alone is responsible for 4.5 percent of the world’s industrial greenhouse gas emissions between 1988 and 2015.

This data is extremely useful for people trying to bring legal cases against fossil fuel firms. In May 2022, a group of scientists and lawyers traveled to the Peruvian Andes to inspect a giant glacier that looms over the crystalline waters of Lake Palcacocha. If the glacier collapses into the lake, scientists fear it could submerge the nearby city of Huaraz. Peruvian farmer Saúl Luciano Lliuya thinks that polluters should foot the cost of defending the city from floodwater as global warming has shrunk glaciers around Lake Palcacocha, increasing the risk of dangerous flooding. The target of the lawsuit is the Germany energy firm RWE, which was responsible for 0.47 percent of all industrial greenhouse gas emissions between 1751 and 2010, according to Heede’s data. Lliuya is

suing for just £14,250—that’s 0.47 percent of the cost of protecting Huaraz.

If Lliuya wins the case it could set a precedent that polluters can be held legally responsible for the effects of their emissions anywhere on the planet. “That would really change this narrative that we’re operating in,” Otto says. It would also make the work of weather attribution even more critical. If scientists know that climate change had made flooding in an area twice as severe as it would have been, for example, they can use that evidence to estimate how much individual companies and states contributed to that disaster. One of Otto’s students is already working on a legal case in Brazil that involves weather attribution. “We have seen a huge interest in that. It’s not just journalists calling and wanting to know, but also lawyers,” Otto says.

Despite the booming interest in the field, World Weather Attribution is still almost entirely run by scientists working for free in their spare time. Eventually, Otto hopes that the task of weather attribution could become a routine part of weather services, which would give her more time to focus on the science of hurricanes and droughts, which are much more difficult to analyze. But for now, her main focus is making her attribution studies more useful to lawyers and helping achieve some justice for the people most affected by climate change. “Climate change will never be a catastrophe for those who are rich. And I think that’s why it’s ultimately a justice issue, because those who pay are the ones who are the most vulnerable in society.”

075

MATT REYNOLDS

(@mattsreynolds1) is a WIRED senior writer, and covers climate, biodiversity and food.

THE EU GREEN DEAL *EUROPE'S PLAN TO BE THE FIRST CLIMATE NEUTRAL CONTINENT*

076

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he European Union is done talking about climate change; it wants to act. The world's second largest economy aims to be the first climate neutral continent by 2050, with emissions slashed 55 percent by 2030 (compared to 1990 levels). The European Commission unveiled the Green Deal in 2019, redesigning Europe's energy, food and transport systems. "This is Europe's man on the moon moment," said Commission President Ursula von der Leyen.

The Green Deal is still a proposal. Large parts are yet to be passed into law, and some member states still need convincing that the costs will be worth it. The Commission has said the plan will require €1 trillion in sustainable investments. Even targets already agreed aren't binding. One EU official, Thierry Breton, suggested an agreed law to phase out fossil fuel cars by 2035 could be delayed if it proves unrealistic.

Before the Green Deal becomes a reality, years of political battles remain—but it does offer a vision of how a modern economy could work in a world that takes climate change seriously. *Morgan Meaker*



Sea Power

The Green Deal plans to accelerate investment in renewables, especially offshore wind, tidal energy and other power sources that would take advantage of the bloc's 68,000 km of coastline. But the Green Deal is not all about renewables. Hydrogen is also expected to be a key replacement for natural gas.

Renovation Wave

Europe is famous for its picturesque buildings—think Copenhagen’s rainbow waterfront or the iconic rooftops of Paris. But the Commission has branded roughly 75 percent of them as energy inefficient. The Green Deal proposes a mass renovation of existing residential, commercial, and public buildings to ensure all existing structures are zero emission by 2050.

Future Forests

Europe’s forests and woodlands are facing increasing threats from human activity, disease, and forest fires. Yet healthy forests are critical for carbon storage and sequestration. That’s why the Green Deal aims to improve both the quality and quantity of Europe’s forests, partly by planting three billion trees by the end of the decade.

From retrofitting older buildings to be zero-emission to rethinking farming, electrifying transport, and prioritizing reforestation, a net-zero Europe could look very different

Farm to Fork

The EU’s Farm to Fork strategy aims to reduce the environmental footprint of the bloc’s food system by slashing pesticide use and cutting sales of antimicrobial medicines, such as antibiotics, for farmed animals by 50 percent. It also proposes to boost organic farming and find ways to increase the number of bees on agricultural land.

Blue Economy

More than four million people work in Europe’s marine industries, and the Green Deal wants to reduce the environmental footprint across this “blue economy”. Alongside decarbonizing marine transport, that will also mean finding ways to reduce microplastic pollution, reverse biodiversity loss, improve ship recycling, and also incentivize fishers to collect litter and retrieve fishing gear lost at sea.

Electric Avenue

Imagine a future where highways are lined with electric charging points, cycle lanes criss-cross cities, and it’s easier to travel by high-speed rail. That’s the Green Deal vision for transport’s zero-emission future. But the proposal doesn’t spell the end for other forms of transport. Instead, the plan is for planes and ships to run on sustainable fuels.

Science Superpower

Much of the success of Europe’s Green Deal will rely on the green alternatives that can replace fossil fuels or solve industries’ problems with waste. That’s why the EU is channeling huge amounts into funding new ideas. So far, the €1 billion Green Deal research call has supported projects that aim to produce green hydrogen in Germany, or predict forest fires in Spain.





“Trying to make a whale compliant with market-based logic is how most governments are trying to approach the climate crisis, and I think it captures the absurd and brutal way that economics engages with nature.”

ADRIENNE BULLER

HOW MUCH IS A WHALE WORTH?

079

It seems a ridiculous question, borderline obscene—whales are majestic creatures whose worth transcends the human impulse to quantify, obviously! Yet it is one which has been seriously considered by economists in an effort to convince governments and corporations to value wildlife. In her recent book, *The Value of a Whale: On the Illusions of Green Capitalism*, Adrienne Buller dissects the asinine logic of “green” capitalist thinking, from putting a dollar value on cetaceans to carbon offsets and financial products such as “sustainability-linked bonds.”

The director of research for the London-based progressive think tank Common Wealth, Buller sees market-based corporate “green” initiatives as distracting at best—and, at worst, actively destructive. *The Value of a Whale* takes a bracing look at how corporate interests are using the superficial trappings of climate activism to reinforce their own power. As one might imagine, it’s not the most uplifting read in the world. But it’s a galvanizing, tough book, one that asks us to not accept a simulacrum of improvement for the real thing.

WIRED talked with Buller about whale pricing, the effectiveness of direct action, and reasons to find hope for the future. This interview has been edited for clarity and length.

WIRED: Could you define “green capitalism” for those who might not be familiar with the expression?

Adrienne Buller: The way I define it in the book is intentionally a working definition. It addresses a phenomenon we’re seeing in the US and in the UK where the corporate sector and financial firms have realized overt climate denialism and obstruction is not a viable strategy, so they’re slowly transitioning toward trying to shape and control climate policy.

There are two core tenets of green capitalism I identify. The first is that it’s an attempt to resolve the climate crisis in a way that minimizes disruption to our existing ways of organizing the economy to existing distributions of wealth and power. The second tenet is pursuing decarbonization in a way that makes sure that there are still opportunities for profit-making and rent extraction in that decarbonized future. In contrast to, for instance, moving away from private car ownership to mass transit as a climate solution, the green capitalist framework is more about making sure we can transition to electric vehicles when we’re moving away from fossil-fuel-driven cars, so that private companies can keep profiting.

You titled the book after an especially

2. Adrienne Buller

Director of research,
Common Wealth

Adrienne Buller is director of research at Common Wealth, a think tank focused on democratic ownership and its potential to transform global economies, and is the author of *The Value of a Whale: On the Illusions of Green Capitalism*.

‘HAVING PEOPLE TURN UP TO PROTESTS IS INCREDIBLY VALUABLE.’

striking example of how absurd green capitalism can be. The International Monetary Fund decided to place a price on whales: about \$1 trillion for the whole species, or \$2 million per individual whale. They arrived at this figure by calculating how much carbon whales sequestered and saw it as advocating for whale conservation as a way to fight climate change. What made you choose this particular example to open the book?

For me, it captures everything about green capitalism that is both seductive in an intuitive sense, and then also deeply problematic in a practical sense. On the one hand, there’s this intuitive appeal to the idea that the reason that we destroy nature is because we don’t value it within our economic system, so we need to find a way to do that. It’s the idea that if we can just make governments or the corporate sector appreciate the role that elements of nature, like a whale, have in things they care about—money, a stable economy, etc.—then that can be a solution. Trying to make a whale compliant with market-based logic is how most governments are trying to approach the climate crisis, and I think it captures the absurd and brutal way that economics engages with nature. Plus, I just love whales.

Toward the end of the book, you write that green capital solutions are at best a “deadly distraction”, and at worst are “actively undermining” our ability to slow and adapt to climate change. It’s a persuasive but depressing argument, because it feels like we are very far away from a green socialism or a green anything else arriving. Are there any projects to fight climate change you see worth pursuing within the current global capitalist system?

It’s a dire conclusion now that you read it back to me! But the case that I try to make is that there are lots of ways to pursue really good policy within our existing system, policies that might prefigure a much more radical re-imagining of the future. These might be reforms that operate within the

current system and try to make it slightly better. The ones I find most encouraging are the ones that are linked to a much bigger shift in either perspective or in the way that we arrange things. So the Inflation Reduction Act [IRA, a landmark clean energy bill in the US] is a good example of this. There are a lot of flaws with the IRA that we won’t unpack here, but one thing that I find really encouraging about it is that for the first time in American climate politics, it represents a shift away from a fixation on pricing and the price system as the way to resolve this crisis. That’s a really interesting shift in mindset that speaks to a much bigger project for re-imagining how we organize our economy.

In the UK, the Labour Party announced a plan to build a public option clean energy company to compete with the big fossil fuel generators. I think, again, it’s an encouraging shift, and while it’s still operating within capitalism, it moves us away from a world in which everything has to be justified on the basis of profits.

Do you have any suggestions for direct actions that readers can take to help galvanize a larger shift in the way that we approach climate change?

Having done climate activism for years, it often feels as though going to the protests is doing very little. The state often feels like an immovable beast. But I do think that having people turn up to protests and having people be part of those movements is incredibly valuable over a longer trajectory, even if in the near term, it might be disheartening. So I would encourage everyone to give it a try.

The other thing would be this: One of the most powerful forces that we’re going to need to not only drive a transition away from our fossil fuel and carbon addiction, but also to do so in a way that is just and fair, is to have the trade union movement on our side. And so I think anyone who is in a trade union or has thought about joining one should do so and try to bring pressure from the inside, so unions can be really vocal on the climate crisis. They’re often representing the workers that are going to be critical to the future. I think the joining up of the climate movement and the labor movement would be an incredibly powerful nexus, and it’s happening already. **Kate Knibbs**



Adrienne Buller says a key component in driving decarbonization will be uniting the climate movement with the labor movement.

CLIENT EARTH DEFENDING THE PLANET, CASE BY CASE

In March 2017, a storm hit the Torres Strait Islands, a scattered archipelago off Australia's northern coast. On Masig Island, a low-lying coral cay that's home to some 270 people, the wind ripped down trees, and huge tidal surges flooded houses and an old cemetery.

The next day, Yessie Mosby—a power station engineer, musician, and craftsman—was walking on the beach with his children when he found the skeletal remains of his grandmother, exhumed by the storm, lying on the sand by the shore.

The sacred burial ground was once a good distance from the water, but the sea had been creeping closer as erosion ate away the low-lying land. Mosby spent the day with his family gathering bones.

"I was holding her jaw and my uncle was holding the top part of her head, and we were placing them in buckets," he says over Zoom from his island home. "I was, like, 'Nah, man, this is not right.'" As he watched his children collecting his grandmother's ribs "like shells off the beach," Mosby broke into tears. "I said, 'Something has to be done'."

But getting something done was a daunting task. The Torres Strait's 274

islands and their indigenous peoples have long been overlooked by the Australian government. Despite its fascinating culture, it's an area that many Australians would struggle to find on a map. The nearest state capital, Brisbane, is more than a thousand miles away—a three day journey by bus and ferry, with no direct flights.

Local politicians had been asking authorities for money for sea walls and other infrastructure, but the government's best offer was to move the whole community to the mainland—and leave their way of life behind.

But Mosby was lucky. A young lawyer knew Masig Island, and two years after Mosby's macabre find, she represented a small group of islanders in a legal action that could change the way countries are held to account on climate change, and help people save their way of life.

In 2009, law graduate Sophie Marjanac took a junior job in the Australian government department that manages indigenous land rights in the Torres Strait. She fell in love with the culture and the people, but saw how the islands were changing.

New houses were being built on stilts to counteract flooding. Old trees were dying as their roots were eaten away by the sea. Sometimes, whole sections of islands disappeared. Fishing seasons were disrupted, crops struggled, and life for the Torres Strait islanders got harder every year. "The whole culture is based on seasons; they know that when the stars are at a certain place in the sky at a certain time of year, that's when those fish are jumping or that's when that tree is fruiting," Marjanac says. "Climate change turns everything on its head."

By the time the storm hit the islands in 2017, Marjanac was working for ClientEarth, a London-based team of lawyers who challenge companies and governments on their environmental record. Visiting ClientEarth's London office on an unseasonably warm fall afternoon feels a little like a trip to Silicon Valley—it's based in a converted industrial space with plenty of exposed brickwork.

But ClientEarth is a charity, founded in 2006 by US-born lawyer James Thornton, who made his name in the 1980s battling with the Reagan administration to get the Clean Water Act enforced. Thornton founded ClientEarth to act as the "special forces" of the environmental movement,

with the Earth his most important client.

Initially, Thornton thought lobbying would be ClientEarth's most powerful tool—talking to scientists and policymakers, and influencing the development of new laws. But it soon found itself using legal action to make sure existing laws were being enforced properly, too.

In 2008, ClientEarth forced the UK government to fulfill its legal duty to conduct environmental assessments of two proposed coal-fired power plants at Kingsnorth in Kent. It followed that by challenging the French government to enforce an existing European Union ban on drift-net fishing, which has been outlawed since 2015, as the nets can trap sharks, dolphins, whales, and even seabirds.

By 2010, ClientEarth's lawyers had realized they could also protect the planet not just by influencing new laws and enforcing old ones, but also by setting precedents that used existing laws in new, far-reaching ways. In Poland, from a new office in Warsaw, it challenged the construction of new coal power stations and sued the Bełchatów power plant, Europe's biggest coal-fired power station, which had emitted a billion tonnes of CO₂ into the atmosphere over its lifetime. Even though Bełchatów was technically operating within environmental regulations, ClientEarth argued that under Polish law the company owners were obliged to take care of public interest and public health. The judge agreed, set a legal precedent, and the plant closed down.

Today, ClientEarth has 300 staff and offices in Brussels, Berlin, Madrid, Los Angeles and Beijing. It has continued to co-opt existing laws for new purposes:

4. Sophie Marjanac

Climate accountability

lead, ClientEarth

Sophie Marjanac specializes in strategic litigation to ensure governments and companies meet their Paris Agreement commitments, and in the interpretation of laws such as Human Rights to achieve justice and action for peoples affected by climate change.



Storms have deeply damaged Masig Island, including disinterring bodies from its cemetery.



Masig Island, one of the Torres Strait Islands, is being steadily eroded away.

‘ALL WE NEED TO SAY IS, “DON’T MAKE ME WRITE YOU ANOTHER LETTER.”’

In April 2020, it successfully pressured Barclays Bank into announcing a net-zero target by suggesting its fossil fuel investments were placing the company directors in breach of their fiduciary duty.

Under the UK Companies’ Act 2008, fiduciary duty includes acting in the best interests of the company. ClientEarth argued that Barclays’ fossil fuel investments were damaging the company’s long-term survival—a breach of the directors’ duties. In March 2022, ClientEarth took legal action against Shell’s board of directors on behalf of the company itself, to hold 13 of them personally responsible for Shell’s failure to pursue carbon neutrality. It’s waiting for a response.

“We are acting in love, not anger, to stop the company being driven off the cliff by these directors,” explains Laura Clarke, ClientEarth’s new CEO, who took over day-to-day running of the charity in September 2022, as Thornton became its president. “And we are going for the board of directors’ sense of personal responsibility. That is a powerful point of leverage.”

ClientEarth’s interpretation of fiduciary duty has never been applied before, says Marjanac, but that will change. “Fiduciary duty is about prudent risk management. Human rights are about the inherent dignity of the individual. The crises of the modern world are the climate crisis and the biodiversity crisis. It’s only natural that the law will step up and adapt.”

In the case of the Torres Strait islanders, Marjanac and ClientEarth turned to Article 27 of the Universal Declaration of Human Rights, protecting an individual’s right to participate in their culture.

Article 27 was originally designed to protect minority groups against genocide and colonial mismanagement in the wake of the Second World War, but ClientEarth sought to adapt and extend its protections.

In September 2019, Marjanac presented a petition to the UN Human Rights Committee, a body of 18 legal experts that oversees compliance with the treaty.

ClientEarth argued that the Australian government’s failure to protect the fragile ecosystems of the Torres Strait violated the islanders’ Article 27 rights to their culture, and their Article 17 rights to be free from interference in privacy, family and home. “We all have a right to family, home and culture under international law,” Marjanac says. “When I was there even the children said, ‘if we had to leave the island we couldn’t leave our loved ones—we couldn’t leave the grandparents and the great grandparents behind.’”

The Australian government fought back. In August 2020, it asked the committee to dismiss the case, denying that climate change was impacting the human rights of the islanders, and that—because Australia is not the main or only contributor to global warming—the effects of climate change on its citizens are not its legal responsibility under human rights law. Later that year, the UN’s legal experts agreed with the islanders, but the Australian government doubled down, arguing

that it was already doing enough to fight climate change, and that future impacts were too uncertain to require action.

As it waited for the final UN decision, ClientEarth continued to pressure governments and organizations around the world. In July, as the UK sweated through record temperatures, the High Court ruled in ClientEarth’s favor, finding that the Government’s net zero strategy breaches the Climate Change Act and needs to be strengthened. The charity launched cases in Poland from farmers, business owners, and parents suing the government for failing to reduce greenhouse gases. There’s legal action looming in France over corporate plastic pollution by nine of the country’s largest food companies.

Clarke and her team are helping the EU strengthen anti-deforestation legislation, and advising the Chinese Supreme Court on how to green up the Belt and Road Initiative. “We’re at the point where all we need to say is, ‘Don’t make me write you another letter’,” she says.

Finally, in September 2022—three years after the initial complaint—the United Nations Human Rights Committee agreed with ClientEarth’s interpretation of human rights in the face of climate change. Australia had violated the right to culture, and the right to be free from interference with privacy, family and home. The Committee asked the Australian government to compensate the islanders “for the harm they have suffered, to engage in meaningful consultations to assess their needs, and take measures to secure their communities’ safe existence.”

Securing the money will take time, but the ruling means other low-lying areas finally have a legal recourse in their battle to survive. The committee specifically rejected Australia’s claim that individual countries can’t be held responsible for the effects of climate change, and agreed that international environmental obligations are a human rights issue.

It was early evening in the Torres Strait when the news reached Yessie Mosby. “I shed tears of joy, and I know that my ancestors were rejoicing,” he says. “I know that it’s not the end, but I know that a lot of doors have been opened. I was so happy that I wouldn’t be a refugee. Nobody on Earth should be asking their children to put their grandmother’s remains in a bucket.” **Stephen Armstrong**



LUBOMILA JORDANOVA *DATA CAN CREATE NEW OPPORTUNITIES TO DECARBONIZE BUSINESS*

Some big companies deploy a wealth of tricks to keep their climate pledges on track. They use vague and misleading wording to improve their image without making any real changes. They offset corporate travel through donations to environmental projects, but don't fly less. And then there's creative climate accounting: furniture giant IKEA, for example, counts the carbon stored in its wooden chairs and beds, even though they're unlikely to grace a home for as long as the trees they come from would have stayed in the forest. When it sells a solar panel to a household, IKEA puts the emissions saved in its own carbon credit column, too.

Known as "greenwashing", these tactics also occasionally happen by accident. "I don't think all greenwashing is intended," says Lubomila Jordanova, the founder and CEO of Berlin-based carbon reporting firm Plan A. During a trip to Morocco in 2016, Jordanova became aware of how much humans were harming nature. Instead of surfing with her friends, she spent a week picking plastic from the beach. Back home, she educated herself about climate change and pollution, and realized that businesses are the key to combating them on a large scale. "Because they have capital, they have people, they have visibility and also a lot of influence," she says.

But she quickly learned that even companies that wanted to tackle climate change, and specifically their own green-

house gas emissions, weren't always going about it the right way.

Under pressure from investors, partners and consumers, companies have stocked up on reporting tools, and adorned themselves with flawed green credentials. Because of the low level of education in the market, Jordanova says, some companies are making misinformed announcements about their decarbonization. They might think they're doing the right thing, even if they're not. "There will be a lot of shiny dashboards sold as carbon accounting software or sustainability optimization tools," Jordanova says.

Jordanova also sells dashboards. But Plan A doesn't promise "net zero" or "carbon neutral" labels; instead it offers a digital platform that processes corporate data through automation and prediction. Its users can then track their emissions and identify areas—whether in manufacturing, the workplace or business travel—where they could reduce more, faster, and help mitigate the worst effects of climate change. However, tackling these hotspots is not so easy, especially when a company's products are characterized by a long and globalized value chain—relying on materials and resources from all over the world.

Take BMW, for example. Since 2020, the German carmaker has been using Plan A's platform to calculate monthly emissions from sources it owns or controls. "The platform starts with what we call data mapping," says Jordanova. Companies make their existing data available. Where there are gaps, Plan A uses proxy measurements. "It gives us a really good opportunity to understand the data maturity of the company, but also enables them to see the sustainability picture from all these different sources in a single place," she says.

After mapping comes planning.

Sustainability professionals, warehouse managers, CFOs or whoever uses the platform are given a to-do list for decarbonization. "It explains specifically what kind of materials you need to switch to, what stakeholders you need to involve, and who is responsible for this decarbonization activity," Jordanova says. The science-based approach to analyzing company data and setting targets is particularly important to Jordanova. Reducing emissions takes precedence over offsetting, although companies still have the option to purchase schemes to balance out unavoidable emissions, as is common in industry.

The next step is reporting: important for investors, business partners, and increasingly for consumers and regulators, too. The platform generates automated reports on a company's envi-

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3. Lubomila Jordanova

Cofounder & CEO, Plan A

Lubomila Jordanova is cofounder and CEO of Plan A, a platform that uses AI and machine learning to help businesses decarbonize via carbon accounting throughout their entire supply chain and operations, as well as providing ESG reporting.

ultimately recycled. “If you take a company like BMW, you’re talking about a vast, transformational challenge that is related to engaging not only your internal entities, but your suppliers,” says Jordanova.

In October 2022, Plan A introduced a module that also allows companies to track emissions along the value chain (Scope 3). Specifically, this means that third parties such as suppliers or logistics partners are invited to feed their data into the platform. “This creates network effects for the whole decarbonization assessment,” says Jordanova.

For companies to avoid greenwash-

ing, it is important that they disclose all areas of emissions in their reports. Otherwise, their goal of achieving net-zero emissions may look good on paper, but be bad in practice—and well-meaning investors, partners, and consumers could be misled. ESG reporting has become even more important in recent months as regulators in Europe and the US are cracking down on greenwashing, causing companies to shy away from big green announcements, Jordanova says. “All these net-zero targets are meaningless if we don’t really understand what it takes to achieve them.” *Sabrina Weiss* ■

‘BUSINESSES ARE KEY. THEY HAVE CAPITAL, PEOPLE, VISIBILITY, INFLUENCE.’

ronmental, social and governance (ESG) impacts, which are roughly divided into three groups: Scope 1 are direct emissions from company-owned and -controlled resources, Scope 2 are indirect emissions from purchased energy, such as electricity, heating or cooling.

Companies around the world must report these according to the standardized Greenhouse Gas Protocol. And they can do even more if they want to: Emissions from the value chain, so-called Scope 3, for which companies are indirectly responsible, are often the biggest sticking point in decarbonization.

Let’s return to the example of BMW. The group already buys electricity from renewable sources for its plants—there are even four wind turbines on its site in Leipzig. But what happens before and after production is also crucial. For example, around 70 percent of current emissions occur once the cars and motorbikes are being driven by their new owners. The switch to all-electric vehicles brings BMW closer to its goal of reducing the overall carbon footprint of its vehicles by at least 40 per cent by 2030 compared to 2019. To do this, it must also get to grips with how lithium, cobalt and other metals in its batteries are mined, processed, and



Lubomila Jordanova was inspired to set up Plan A after a holiday to Morocco, which she ended up spending collecting plastic from a beach.



PENNY

GREYHOUND

AGE: 14

LIFESPAN: 10-13

STAY.

The search for a pill that can help dogs, **AND EVENTUALLY HUMANS**, live longer.

BY TOM SIMONITE

PHOTOGRAPHS BY JOE PUGLIESE

CELINE HALIOUA DROPS into a crouch and greets Bocce, a Chihuahua-dachshund mix with soulful brown eyes, like a long-lost friend. “Oh my god, you’re so beautiful!” she chirps. The two have just met in an upstairs room at Muttville Senior Dog Rescue in San Francisco, where light streams in through the open windows and urine occasionally streams onto the floor. About a dozen elder dogs, none taller than a kneecap, putter around on the gray linoleum or nap on blankets. When Halioua kneels, her dark hair tumbling over her shoulder, Bocce rests his head blissfully in her lap.

A tragedy of human-canine relations is that a 10-year-old dog such as Bocce is elderly, while a 28-year-old person such as Halioua is in the prime of life. Bocce is one of the lucky ones. Many dogs can only dream of living as long as he likely will, because dog lifespan is inversely correlated with body size. It’s the opposite of the wider pattern in the animal kingdom, where elephants easily outlast mice, which in turn outlive mosquitoes. A Chihuahua can expect roughly 15 years of life; an Irish wolfhound or Great Dane around seven or eight.

Halioua hopes that the startup whose name is emblazoned on her slim black T-shirt—Loyal—can start to fix this bug in humanity’s 14,000-year-plus wolf bioengineering project. The company, which she founded in 2019 and leads as CEO, is developing drugs to delay aging in dogs and extend their healthy lifespan. She has raised around \$58 million and has two drugs in development. In a few years, she hopes to have the first commercial drug—for any species—to state on the label that it delays aging or extends lifespan. That alone would be a triumph, but Halioua sees it as a springboard to a still greater feat: creating similar drugs for humans.

The search for an antiaging elixir goes back at least to the *Epic of Gilgamesh*, and even today the most far-out ideas for thwarting death—freezing people for eventual revival, reincarnating them digitally—sound an awful lot like technological fairy tales. But in the world of lab animals, life extension is already here, with studies boosting or even doubling the lifespans of worms, flies, and mice. Regulators such as the US Food and Drug Administration, though, have not yet recognized aging as a condition that can be treated.

Halioua, a fast talker who speaks in a confident, sometimes bewildering mix of Silicon Valley and

0 8 8

Celine Halioua has tattoos of a worm, a mouse, and a dog: organisms used in aging research.



WOLFIE

HUSKY

AGE: 10

LIFESPAN: 12-14



CELINE	HUMAN
AGE: 28	LIFESPAN: 79



SMITTY & LOUISE

CHIHUAHUAS

AGE: BOTH 10

LIFESPAN: 14-16

biotech jargon, believes that starting with dogs puts her on the best and cutest path to the first aging treatments for people. There's no escaping the poor odds of any treatment succeeding—about 90 percent of new drugs crash out of clinical trials as failures. But running a doggie clinical trial is cheap compared to a human one, and the animals' shorter lives mean it won't take decades to know whether a pill boosts longevity. Plus, the lifespan and lifestyle of a pet dog are more humanlike than a lab mouse's is, so Halioua argues she'll be in a good position to leap from pups to people.

For Halioua, who survived a toxic stint in academia before founding her company, Loyal is a way to work against aging on her own terms. That it happens to involve dogs—animals she has loved since her upbringing in suburban Texas—is canine kismet. It gives her an excuse to hang out at Muttville, for one, where Loyal has worked with the staff to recruit owners and their dogs into two studies of aging.

Sitting cross-legged on the floor, Halioua can imagine Muttville caring for a more diverse crowd if Loyal's drugs work. "In that world, the age of dogs here would maybe go out from 10 to 12 or 14," she says, as a glossy black spaniel mix with a grizzled muzzle named Snoop Dawg methodically licks her right arm.

For many dogs lucky enough to have homes, life has never been better. Pet parents invest more cash and emotion in them than ever and grant them a social standing that creates what sociologist Andrea Laurent-Simpson calls multispecies families. A drug to lengthen their time together would seem to be an easy sell. And should dogs end up delivering more years to humans? You couldn't ask a best buddy for more.

HALIOUA WAS A sophomore majoring in neuroscience at the University of Texas at Austin when she discovered aging research. In a departmental newsletter, she spotted an ad for summer internships at leading labs working on age-related disease, decided to apply, and got a position at a prestigious independent stem cell lab in La Jolla, California. She'd never heard of the internship's sponsor—a Silicon Valley-based nonprofit called the SENS Research Foundation, whose mission was to "help build the industry that will cure the diseases of aging." Its cofounder and scientific mastermind was a Merlin-bearded computer scientist turned aging researcher named Aubrey de Grey. He was a fringe but high-profile voice in a corner of biology that itself was not fully established.

In 1993, shortly before Halioua was born, a team of molecular biologists at UC San Francisco, led by Cynthia Kenyon, showed that partially disabling a single gene in the millimeter-long nematode worm *Caenorhabditis elegans* could double its lifespan. For the worms in Kenyon's lab, that equated to an additional 24 days spent eating *E. coli* bacteria, but the title of the group's report in a nematode newsletter drew a provocative analogy to humans: "A Mutation Which Doubles *C. elegans* Life Span (Imagine Being 140)." The study helped ignite a new field dedicated to unpicking, and wresting control of, the biological mechanisms of aging.

Kenyon and other researchers tracked down genes linked to longevity and traced the biochemical pathways they controlled. Intriguingly, some of the same mechanisms they identified in worms could extend life in flies and mice. In labs around the

world, evidence began to mount that aging was not just inevitable degradation. It was another biological process with genetic controls and components that might one day be hacked. The long lives of some wild animals hinted at the possibilities. DNA repair mechanisms help one of the longest-lived mammals, bowhead whales, live to 200 or more. Naked mole rats and some tortoises appear to slow biological time, making them remarkably resistant to age-related disease.

De Grey was inspired by the science but irritated by what he saw as society's indifference to the prospect of slowing or even reversing aging in humans. In 2003, he drew interest to his cause by celebrating a dwarf mouse known as GHR-KO 11C, who died at Southern Illinois University a week short of his fifth birthday—roughly double his expected lifespan—thanks to a tweak similar to what Kenyon had done to extend worm longevity. De Grey announced that 11C's creator had won the first payout from the Methuselah Mouse Prize, a fund of about \$33,000 for scientists who set new records for mouse longevity. When speaking about 11C's achievement, de Grey took the opportunity to promote a program he had drawn up called Strategies for Engineered Negligible Senescence that he claimed could eventually defeat aging, allowing a person who was 50 in 2030 to enjoy another 80 healthy years of life.

De Grey's pronouncements charmed journalists but rankled many biologists, and in 2005, 28 distinguished researchers wrote a paper declaring his strategies—using genetic engineering, targeted toxins, and tweaks to the human immune system—a farrago in "the realm of fantasy rather than science." This did little to hinder their target, whose eloquent but wild predictions continued to win media attention and who made headway with tech industry freethinkers. The next year, he received \$3.5 million from Peter Thiel, a cofounder of PayPal. In 2009, de Grey cofounded the SENS Research Foundation, headquartered in Mountain View, California, across the 101 highway from Google.

By the time Halioua started her internship in La Jolla, the foundation was providing small grants to researchers around the world and had labs of its own in Mountain View, directed by de Grey. The summer fellowship program was intended to incubate a new generation of scientists who would dedicate themselves to the organization's vision.

As much by accident as by design, Halioua's summer in California primed her to think more deeply about aging than most teens. She spent her days gazing through a microscope at cells harvested from patients who had died from aggressive brain



ODIN

GREAT DANE

AGE: 4

LIFESPAN: 7-10



LUNA

FRENCH BULLDOG

AGE: 10

LIFESPAN: 10-12

tumors, which, as with most forms of cancer, become more likely with age as changes accumulate in a person's DNA. In the evenings, she returned to a room rented from an elderly but lively veteran with a goofy smile and a hill-running habit. The vet befriended the nervous intern, showing her around La Jolla and inviting her along on dates with his girlfriend. It was her first personal connection with an elder outside her own family. "He helped me realize, 'Oh, I will be this old one day,'" Halioua says.

At the end of the summer, Halioua flew to the SENS Research Foundation's annual conference in San Francisco, where she met de Grey and received a full-immersion baptism in the antiaging Kool-Aid. The crowd mixed respected academic scientists with tech investors, a science adviser to Obama's secretary of state, and, in Halioua's words, "immortalists" hoping to see de Grey's most far-out predictions come true.

The idea that aging might one day be treatable, like a disease, was gaining ground in the world of medical research, and among Silicon Valley's richest men. Shortly after turning 40, Google cofounder and CEO Larry Page announced that his company was backing a new venture called Calico that would work on aging treatments. It hired Cynthia Kenyon, the creator of the long-lived worms and just one of many academics changing the conception of aging. The US National Institutes of Health, the world's largest public backer of medical research, created a "geroscience" initiative to investigate how the aging process contributed to chronic diseases traditionally seen as separate, such as Alzheimer's and cancer, and how scientists might tinker with underlying processes common to them all.

One after another, studies in lab animals were showing that certain drugs could extend lifespan and stave off age-related diseases, a tantalizing glimpse of what people might one day enjoy. Some of them appeared to do so by boosting cellular signals that ramp up when food is scarce, mimicking the effects of a restricted-calorie diet. One of those drugs is rapamycin, taken by humans receiving an organ donation. In mice, it could extend their lives by up to 25 percent and also delay or reverse heart disease, cancer, and cognitive decline—results that were "absolutely astonishing," says Steven Austad, codirector of an NIH aging research center at the University of Alabama at Birmingham. Austad was a coauthor on the 2005 paper slamming de Grey's scientific ideas, but he agreed with the agitator of aging on one high-level point: It was worth seriously investigating how aging might be treated in humans.

IN 2016, HALIOUA returned to La Jolla for a second internship, renting the same room from her elderly friend. She found him diminished and dying from pancreatic cancer. He was still running, but was easily winded, and he was struggling to pay the health insurance premiums underwriting his chemotherapy. Halioua smuggled him extra cash by intentionally overpaying her rent out of her modest fellowship stipend.

De Grey's argument that it was imperative to devote more scientific effort to slowing or halting the processes underlying cancer and other age-related disease began to feel more convincing. "It just made so much sense," Halioua says. "I very quickly knew that this was a hundred percent where I was going to spend my life." At the end of that summer she gave a presentation on her project, impressing an Oxford researcher involved with de Grey's nonprofit. When he suggested she join him in the UK as a grad student, with SENS Research Foundation funding, she accepted. That fall, her La Jolla landlord died. In 2017, she flew to England with a new mission in life.

Halioua fell in love with Oxford. Her thesis examined how health systems might cover treatments that only paid off far in the future, a potential challenge for antiaging drugs. She had a part-time job consulting on science with a biotech startup that was also backed by the foundation. But her new life began to fracture.

Halioua's relationship with her supervisor broke down. She felt he bullied her and was controlling, requiring her to do work related to a company he worked for and restricting whom she could talk with. (Halioua has spoken publicly about her experience without naming her supervisor. He did not respond to a request for comment.)

She also became uncomfortable with the SENS Research Foundation and its animating spirit, de Grey. She initially admired the foundation, she says: "They had a lot of glitz and glam for me." She was impressed by the organization's formal dinners, where rich and distinguished men were encouraged to donate to the war on aging. But she started to suspect she was only being invited "because I was a cute young girl," she says. "Also smart, but that wasn't what they cared about." At one dinner, she says, de Grey plied her with alcohol and told her that as a "glorious woman" she had a duty to have sex with potential donors to encourage contributions. (After Halioua went public with her allegations several years later, de Grey denied making the statements.)

By 2018, Halioua was looking for an escape route. "I really snapped because of all of that stuff Aubrey and my professor did," she says. "It created this desire to create my own sphere of influence, where I control the rules." She turned to one of the only prominent women in the small circles working on aging treatments, Laura Deming. Deming was a wunderkind who had started working at age 12 in Cynthia Kenyon's lab, enrolled at MIT at 14, dropped out after receiving a fellowship from Peter Thiel, and now ran a venture capital fund in San Francisco to bring aging-related startups into the Silicon Valley mainstream. (One of her latest projects involves developing technology to freeze organs without damaging them.) Halioua had once been introduced to Deming through de Grey, and now she emailed in pursuit of an internship.

Deming arranged a brief phone interview. Halioua was "very intense,"

Deming recalls. “I asked her a question about Markov models”—a math trick to analyze processes that change over time—“and could tell that she didn’t have the exact answer but was determined to figure it out on the call” by wringing every possible clue from what Deming said. “That was really cool.” The internship was only two weeks long, but for Halioua it was enough—a refuge and perhaps a new beginning. In early 2018, she flew to California.

HALIOUA JOINED DEMING at a WeWork in the Tenderloin, a San Francisco neighborhood abutting City Hall and the headquarters of Twitter that is also rife with human misery and crime. Stepping out of the office at night felt risky in a way it never had in Oxford or Austin. Working in venture capital felt unfamiliar too. At Oxford, grad students and researchers left the lab at 5 pm and went home or to the pub. Important emails were long and formal. In San Francisco, entrepreneurs and investors worked late and then spent hours more, over fine dinners, debating the intellectual foundations of their theories about the future.

At the end of Halioua’s brief internship, Deming offered her a job. She found a way to accept but also complete her PhD in Oxford, and began flying back and forth. Halioua felt the arrangement was working at first, but relations with her supervisor worsened, and in the fall of 2018 she filed a formal complaint under Oxford’s bullying and harassment policy. He left the university soon after, but Halioua found her department’s investigation to be painfully slow. (The university did not respond to a request for comment.) While she waited for its official assessment, she began to have panic attacks. “You kind of feel like you’re crazy,” she says. “Everybody tells you you’re being sensitive or misinterpreting what this person said to you.” Working for Deming began to soak up more of Halioua’s time and enthusiasm, and she left Oxford for good.

Halioua knew next to nothing about venture capital or Silicon Valley, but she poured herself into reading pitch decks, networking with founders, and drafting investment memos. She started to tweet, blasting out news of pharma deals, photos of San Francisco beaches, her Fitbit stats, and appreciations of Elon Musk. She helped bring about investments in Fauna, a startup exploring the age-defying biology of hibernation, and Gordian Biotechnology, which aims to fight diseases of aging by modifying a patient’s DNA. By the time news came from Oxford that it had upheld the majority of her complaints, almost a year after she had filed them, Halioua knew her future lay in biotech, not academia.

Halioua’s own company, Loyal, emerged from one of her early projects for Deming, a dense, roughly 50-page memo on the investment potential of the biochemical pathway Cynthia Kenyon had used to double the lifespan of worms. In many species—including humans—it involved a hormone called insulin-like growth factor 1, which adjusts an animal’s growth and metabolic response to food. Tinkering with this pathway

could extend the lifespan of flies, worms, and mice.

Unfortunately for Halioua, the literature seemed less rich in clues for how to turn this knowledge into a drug for people. The role of IGF-1 in human aging was unclear, and although the pathway was clearly implicated in certain eye diseases unrelated to aging, Halioua couldn’t get excited about working on them.

In the summer of 2019, Halioua was drunk on a camping trip among strangers when a factoid she had omitted from the report came back to her. Organized by the founders of an autonomous trucking startup, the trip had brought together a group of young entrepreneurs and investors. Around the campfire, she joked—purely as an icebreaker—that she knew how to extend dog lifespan, because IGF-1 was implicated in dog body size and longevity.

Her quip took on a life of its own and became lodged in the collective consciousness of Silicon Valley. One investor on the trip mentioned Halioua’s idea to a founder he knew, who in turn told it to Greg Rosen, a venture capitalist. Inspired by the South Korean scientists who had produced the first cloned dog, an Afghan named Snuppy, Rosen was looking for an entrepreneur to start a US company to clone dogs for bereaved owners. When Rosen and Halioua met for coffee in downtown San Francisco, he realized she had a better solution for the same underlying problem—that a dog never lives long enough.

HALIOUA BEGAN 2020 with \$5.1 million in funding. By way of thanks she sent all of her investors, including Rosen, fluffy toy puppies wearing company bandanas. She secured an office on the edge of downtown San Francisco, but the lease began in March, the same month the Bay Area became the first part of the US to enter pandemic lockdown. Her company’s formative months, and first hires, took place via Zoom, Slack, and eventually socially distanced meetups. Halioua raised another \$6 million and hired scientists, veterinarians, and an expert in getting new animal drugs past the FDA.

She embraced the role of dog company CEO—painting a mural of a giant German shepherd in Loyal’s office and ordering shirts with the slogan “Save the dogs, save the world.” She adopted a fluffy white husky named Wolfie, whom she has described as her cofounder and Loyal’s chief evangelist. Her management style, she says, was informed by her bad experiences at Oxford. When she talks to her team about her goals or beliefs, she tries to pair her statements with evidence to convince her workers that the boss is being straight with them. “Even if you don’t trust me, you still know this is true,” she says.

CORKY

PUG

AGE: 11

LIFESPAN: 13-15



Halioua's new science team, including a scientist who previously led aging research at pharma giant Regeneron, helped refine her original idea. They identified a compound they believed could be given to young dogs of the largest breeds, such as French mastiffs, to delay their accelerated aging process. They found a second compound they thought could target processes that cause cognitive decline and kidney problems in older dogs of all sizes.

As her company gained traction, Halioua noticed certain patterns in her business interactions. She tried to recruit women investors but found it difficult because there weren't many to ask. When she met with investors who were men, some would try to flip a business meeting into a date, and others would confidently explain science to her that she knew inside out. Mostly she brushed off such moments—her time at Oxford had lowered her expectations of those with more power and prestige than her.

She often felt different. Describing herself as an “Oxford dropout” helped convince people to take her seriously—never mind that she had left her PhD in part due to dissatisfaction with a harassment investigation, a circumstance missing from the dropout tales of archetypal boy geniuses like Mark Zuckerberg. She listened to hundreds of Silicon Valley podcasts to try to learn the industry's patois. She trained herself to smile less and wrote in a blog post aimed at women entrepreneurs: “I come off as more of a grump now, but I am a grump who has the money she needs to build her company.”

In the spring of 2021, Halioua published a blog post about her Oxford PhD supervisor titled “The Gifts of My Harasser,” leaving him nameless. She described the paradox of one of her worst experiences laying a foundation stone for her later successes by teaching her to be skeptical of social hierarchies and institutional power. “It's been two years since I left. I am not broken anymore, but I still feel the cracks,” she wrote. “His abuse shattered my preconceived notions of how the world worked and cleared a path I otherwise never would have found.”

Halioua also still felt the burden of her experience with de Grey, the aging guru of the SENS Research Foundation. Deming, too, had endured an uncomfortable experience with de Grey, whom she had known since she was 14. Days before her 18th birthday, Deming had emailed de Grey, then 59, asking him to introduce her to someone. In his reply he suggested he was interested in Deming sexually. “I have a fairly adventurous love life, and I'm not coy in talking about it, but I've always taken care to avoid letting conversations stray in that direction with someone so young as you,” de Grey wrote. “That has always felt quite jarring given that I could treat you as an equal on every other level. Maybe those days are over ... Ahem - back to business :-) Yes, I'll e-introduce you.” (De Grey later said the email was “an error in judgment.”)

Now, in June 2021, Deming and Halioua heard that de Grey might be mentoring another underage girl. The two women decided to formally report their experiences to the foundation, in the hope that doing so might protect this girl and others. The organization quickly retained a law firm to investigate the allegations and placed de Grey on leave. But in the weeks afterward, the nonprofit promoted social media posts featuring de Grey discussing a cryptocurrency fundraising campaign that would net the organization \$25 million.

By August, Halioua says she and Deming became worried that the nonprofit was too conflicted to properly investigate itself, and they decided to go public. Late one Tuesday afternoon, the two women simultaneously posted detailed statements to their personal websites. Word spread fast, as did Halioua's accompanying Twitter thread, prompting an outpour-

ing of sympathy online, a round of media coverage about the allegations, and denials from de Grey.

Just over a week later, the SENS Research Foundation said its board learned that de Grey had attempted to undercut the ongoing investigation—by sending emails intended to pressure a participant in the inquiry, according to the official report of the investigation—and decided to “separate” from him immediately. The foundation's law firm would later uphold Halioua's and Deming's accounts of these events. De Grey says that the women were tricked by people aiming to eject him from his nonprofit and that he has “never said anything to Laura or Celine verbally or otherwise that had improper intent.”

Halioua felt sure she had done the right thing, and she reasoned that Loyal had progressed enough that her career was not in danger. She was also too busy to dwell on the uproar. In late August her team announced that the NIH's National Institute on Aging would collaborate with Loyal to test two of the company's compounds, as part of a program on extending the longevity or healthy lifespan of mice. Three weeks later she turned 27. She rounded out the month by disclosing that Loyal had raised an additional \$27 million in investment funding. Half of her new investors were women.

IN 2022, HALIOUA and her team, approaching 70 strong, began to flex the scientific muscles needed to upend conventional wisdom about aging. They analyzed and published data collected the previous year from nearly 500 dogs who were brought to a vet clinic for a health assessment. For a second study, they recruited some 2,000 owners—Halioua usually calls them “pet parents”—to receive Loyal-branded doggy DNA swab kits that might help them understand the markers of aging. Dog lovers on social media quickly picked up the scent; both studies filled up fast, and Halioua's inbox was flooded with unsolicited dog pics. (Halioua says she has nothing against cats—and has even hired a few cat fanciers—but that their long lives, dislike of medicine, and not-very-humanlike physiology make them a less appealing target. “They're like little biological aliens,” Halioua says.)

Less publicly, Loyal is preparing for the clinical trials of its two products. Halioua isn't giving away many details about Loyal's drugs, but she does say that both medicines have performed well when given to lab dogs. One is a pill that might delay the onset of age-related diseases such as dementia and kidney failure, two common reasons for owners to have an animal put down. Halioua says it uses some pathways seen in caloric restriction. Now the company is testing the drug in pet dogs, and she anticipates she'll launch a full clinical trial designed to win regulatory approval next year. The second drug, released slowly by an implant, might dampen the cellular processes that are believed to condemn the largest dog breeds to short lives.

As is standard in the drug industry, the company will seek the FDA's sign-off on its study designs first. That step is a big deal for Loyal, because the agency would be backing the notion that drugs can be tested and proven to boost longevity. That is, not to prevent a disease or slow one down, but to hit a whole suite of ailments by tackling aging at its root.

To navigate the scientific and regulatory hurdles, human longevity startups—Loyal's nominal competitors—have taken to focusing on drugs that tick two boxes: They are effective enough to get first approved as a conventional treatment for a single disease, and hold broad antiaging effects. The hope is that once the drug is benefiting patients, data will pile up that helps prove its general preventive powers against age-related disease.

James Peyer, a former venture capitalist who is CEO and cofounder of antiaging startup Cambrian Biopharma, has raised more than \$160 million with that tack. He says that establishing a rich portfolio of nearly 20 potential drugs for humans helped win investors over. But he admits his two-step approach isn't the only way to go, and it's possible that Halioua, whom he has known for years, might have hit on a

faster way to get an antiaging drug for humans. "Part of Celine and Loyal's brilliance is that they found a completely different path," he says, one that lets her focus solely on the drugs' antiaging properties right from the start. If the mechanisms that Halioua's team finds in dogs align with human biology—a considerable unknown—the company could be well positioned to jump species, Peyer says.

Loyal is not the only outfit trying to understand canine longevity. The Dog Aging Project, led by the University of Washington and Texas A&M College of Veterinary Medicine and Biomedical Sciences, has completed two small studies in which owners were given rapamycin or placebo pills without being told which. People who dosed their dogs with the drug reported that their pets became more active, says Matt Kaeberlein, a University of Washington professor who is codirector of the project and an adviser to Loyal. He suspects that rapamycin worked by soothing arthritis or other aches and pains, and he hopes to gather firm proof in a larger trial of about 600 dogs.

Kaeberlein has studied life-extending genes and treatments in yeast, worms, and mice and is convinced some aging mechanisms are shared across the animal kingdom. "Obviously I don't know whether rapamycin is going to have a big effect on lifespan and health span in dogs, but I am as certain as I can be that something will," he says. He declines to say whether he gives rapamycin to his own dog, Dobby, an 11-year-old German shepherd, saying it wouldn't be proper to comment on such a use while running a trial investigating the same. But Kaeberlein will say that he takes the drug himself and believes it helped resolve an attack of frozen shoulder, a mysterious condition in which the joint becomes stiff and painful.

Like other veterans of academic aging science—and Halioua—Kaeberlein exudes levelheaded excitement but also impatience when asked about the future of aging treatments. Piles of evidence suggest it is possible to slow down the processes of aging in humans, or any other animal. You want that pill to exist? Just give scientists the time and money—and regulatory support—to figure it out, says Nir Barzilai, director of the Institute of Aging at Albert Einstein College of Medicine, in New York.

"Right now we need to start making progress with drugs that maybe wouldn't make us live 150 years but will make us healthier for much longer," Barzilai says, by delaying the onset of diseases such as cancer or Alzheimer's. He has spent years trying to secure funding for a six-year human clinical trial to investigate whether a common diabetes drug can delay aging. He is less sure of Loyal's approach, but he figures longer-lived and more active dogs could produce other effects in humans: more active, longer-lived owners, and more support for aging research.

Sitting cross-legged on an easy chair in Loyal's San Francisco office, Halioua argues that Loyal can break the psychological barriers holding back the war on aging. "Many people don't know that we've extended lifespan in mice many times, and even if they do, well, it's a mouse," she says, as Wolfie lolls nearby on a sunny cushion next to a floor-to-ceiling window. What would kick the field into a higher gear, she says, is a proof of concept that's more persuasive and lovable than a wizened lab rodent.

She imagines appearing onstage one day with a healthy Great Dane that is 15 years old, almost twice the breed's usual age—and thus persuading people to see aging science not as a realm of weird ideas and thinkers but as a conventional branch of biotech. Silicon Valley founders are often celebrated for creating products that cause jaws to drop and heads to explode. Halioua may make her greatest mark by killing hype rather than creating it, transforming the notion that drugs can extend life into an everyday comfort—like a faithful friend's tail wagging when you walk through the door. 

BUMPER

AMERICAN STAFFORDSHIRE TERRIER

AGE: 8

LIFESPAN: 13-15

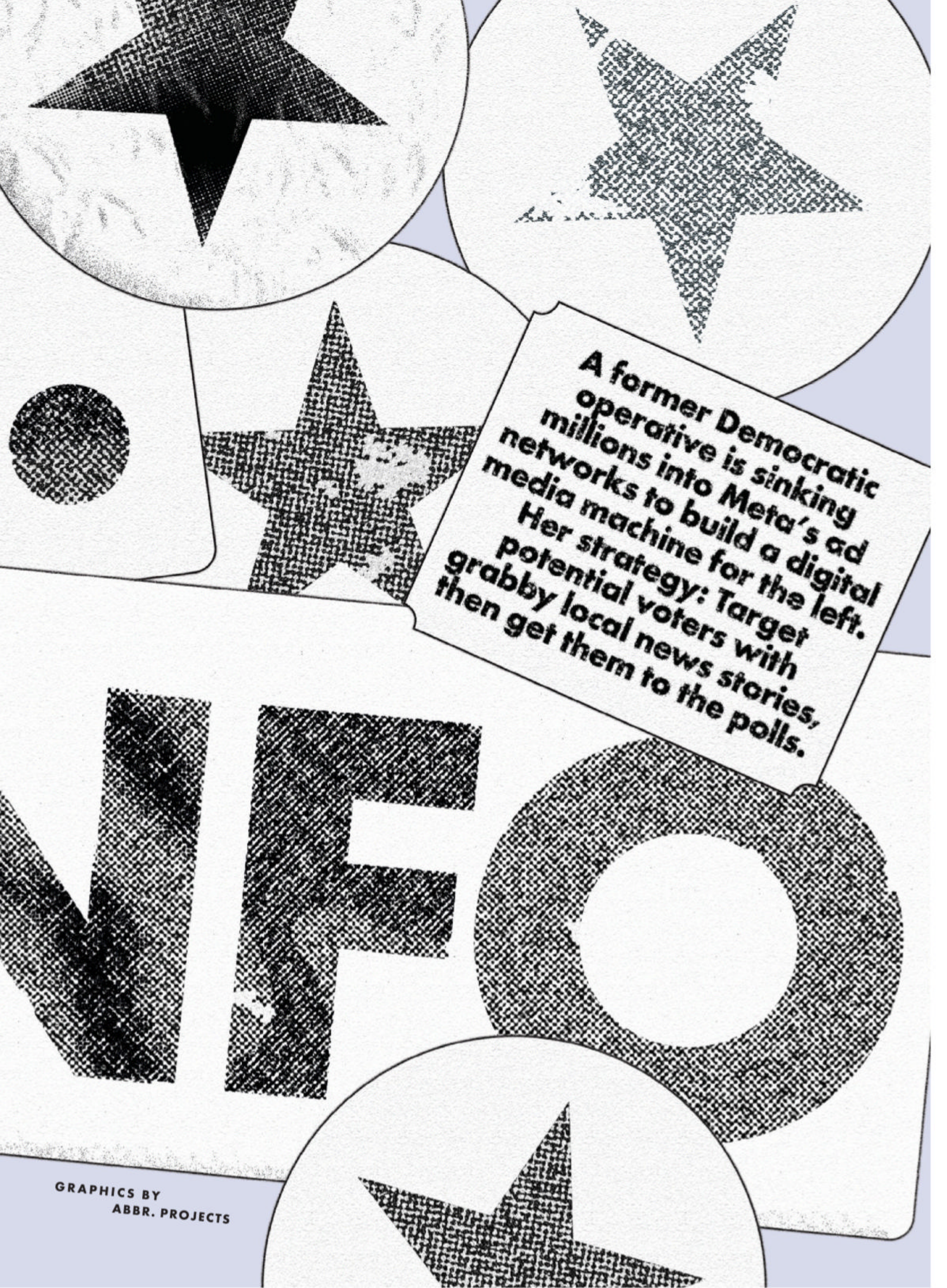


PHOTOGRAPHS BY JARED SOARES

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A former Democratic operative is sinking millions into Meta's ad networks to build a digital media machine for the left. Her strategy: Target potential voters with grabby local news stories, then get them to the polls.

WTF

IT WAS A SUNNY

JUNE AFTERNOON IN WASHINGTON, DC, and even though Tara McGowan professes to hate this city, she was having fun.

A political operative turned publisher, she sat in a conference room in a WeWork office downtown, her fingertips loudly drumming away on the bright orange table. The energetic 36-year-old is the CEO of a company called Good Information, where she oversees a mini empire of progressive local news sites across the United States.

Beaming in on a big videoscreen was Pat Rynard, himself a Democratic operative turned journalist and founder of a small political website called Iowa Starting Line, which *The New York Times* once declared “the ‘It’ read for political insiders.” McGowan had bought the site from him in 2021, making it the eighth in her growing collection of two- to six-person newsrooms stretching from Arizona to North Carolina.

McGowan believes these outlets are the antidote to bad information—the hyperbole and lies that proliferate in Americans’ social media feeds and promote ideas mostly from the ideological right. Through the calculated injection of news stories into these feeds, McGowan thinks she can claw a crumbling republic back from the brink and—this is the important part—get more people to vote. She’s confident these new recruits to the democratic process will lean decidedly left.

Rynard walked her through an experiment in using Facebook’s powerful ad-targeting tools. Iowa’s primary elections were taking place the next day, and he wanted to know whether a handful of Iowa Starting Line’s stories could shape the results. Primaries are the sort of political contest that both keep democracy afloat and tend to be roundly ignored.

“Remind me when the actual boosting of the coverage started?” asked McGowan, sipping from a giant pink water bottle.

“Three weeks ago,” Rynard replied. Working with a political data shop, McGowan’s team had gotten a list of residents in blue-collar counties in the state’s east. They cut the hardcore Republicans from the list, then dumped the remaining names into Facebook’s ad-buying portal. An analyst used the app’s “lookalike” tool to find other people like them, then bought ads that would appear in those users’ newsfeeds. The ads weren’t selling anything; they were just promoting a few stories from Rynard’s site—straight reporting on Democratic candidates vying to run against sitting US senator Chuck Grassley, an infographic of voting deadlines. So far, Rynard was pleased. One ad he’d tossed in on a whim, which riffed on a story titled “Iowa Passed 70 New Laws This Year. Here’s What They Do,” was clicked on by 3.5 percent of the people who saw it. (Digital ads work on painfully small margins; anything above 2 percent is reason to cheer.)

But the experiment was not about clickthrough rates or reading—it was about whether any of those people would actually show up to vote. After the primary, McGowan’s analysts dug into the data. The Facebook ads had cost them \$49,000, which, it turned out, was about what the Democratic winner had spent on the platform. The analysts compared the batch of targeted Iowans with the publicly available list of people who voted. They came back with what they saw as a solid win. About 3,300 more of the targeted residents had turned out to vote than had been forecast to. The ads, they concluded, had worked, and at a reasonable \$15 per vote. That’s about what Biden had spent nationally in 2020 while defeating Trump, though he spent more per voter in swing states.

To McGowan, the results validated years of work. She is a longtime proponent of circulating news through ad platforms to shape political thinking. During the 2020 US presidential election, this “boosted news” technique, along with a suite of data-driven practices and huge sums of fundraised money, helped make her a high-profile if controversial figure in Democratic politics. Now, she says, she has left that world behind for journalism—but brought her political toolbox with her.

Tara McGowan is CEO of Good Information, which runs a set of left-leaning newsrooms.



In its three years of existence, McGowan's army of sites—collectively called Courier Newsroom—has spent at least \$5 million on Facebook and Instagram ads alone. Backed by billionaire LinkedIn cofounder Reid Hoffman, liberal philanthropist George Soros, and others, McGowan says she raised \$15 million in the first half of this year—and she's gunning for more.

McGowan's critics hate what she's up to. As Caitlin Sutherland, executive director of the right-leaning nonprofit Americans for Public Trust, puts it, trying to mobilize voters is “just not something newsrooms do.”

McGowan doesn't disagree. She says that's precisely the problem. Her argument goes like this: Too many newsrooms have lost their way by catering to elite readers and resorting to paywalls. (A rarity a decade ago, now about three-quarters of US newspapers have them.) Meanwhile, more than 2,000 newspapers across the country have closed since 2004, leaving scores of Americans without the sort of trusted information that might propel them to the polls. Instead, about 80 million people who could have voted in the high-stakes election between Donald Trump and Joe Biden didn't. To her, it's self-evident that the journalism world should use every possible tactic to nudge reluctant voters to the ballot box. That idea, though, is breaking the minds of some of journalism's purists, who worry it could backfire—shattering what remains of the public's trust in the press.



ON MCGOWAN'S LEFT ARM IS A TATTOO, in all caps, of the words YES WE CAN. She'd asked former president Barack Obama to write his campaign slogan on her skin, then told him mid-scribble of her plan to ink it; the CAN is noticeably neater. A journalism and political science double major, she had worked for Obama as a digital producer on his 2012 reelection campaign and parlayed that experience into a series of jobs in politics, including as the digital director for Next-Gen America, the climate change organization founded by billionaire Tom Steyer, and as director of digital strategy for Priorities USA Action, the massive pro-Hillary political action committee.



Megan McCarthy launched Dogwood with McGowan and is vice president of content at Courier.

McGowan built a reputation as a digital expert willing to try new things. She and many others thought the left had grown dangerously complacent since Obama's internet-powered victory in 2008. After Trump's upset in 2016, she started an organization called Acronym, which was largely geared toward making sure he and others like him wouldn't win again. The group came to focus on digital advertising tools and was known for aggressively testing exactly which ads worked and sharing the results with others on the left.

But as McGowan tells it, she hated the churn-and-burn of this work—perpetually raising cash to pour into last-ditch online ads meant to pick off a few persuadable voters. She wanted to create something more lasting. Four years ago, she coauthored a report with Eli Pariser, a progressive organizer best known for his 2011 book *The Filter Bubble*, which argued that the algorithm-driven internet was trapping Americans in ideological echo chambers. McGowan and Pariser's report took the position that Democrats were quickly losing power in the United States because they'd neglected to figure out how to navigate that changing landscape. Progressives had opted for bursty spending on TV ads over the right's investment in “always-on, more digitally fluent media infrastructure.”



McGowan wanted to build that kind of infrastructure. She raised a bit of money to build a pilot demonstration in Virginia, where Democrats had a shot at retaking the legislature. Called Dogwood, after both the state flower and tree, it would be aimed at women living in the suburbs and beyond, a constituency that can swing elections there.

The site started pumping out a mix of politics and lifestyle coverage, very much in the vein of a pre-internet local newspaper. Right away McGowan and her team had to contend with what researchers call Americans' increasing "news avoidance"—they don't like to read the news, and they especially don't like to read about politics.

"Our audiences are not being reached by factual news information," McGowan tells me when we meet up at DC's Generator Hotel on one of her visits from her Rhode Island home. It's imperative, she argues, to chase people wherever they are online. She opened her brown eyes wide and spoke uncharacteristically slowly to make sure I got it: "If we don't target them, they won't see it."

Critics howled about a PAC masquerading as a journalistic outfit. McGowan was undeterred. She secured more money and launched sites tailored to unlikely voters in other political hot spots: Arizona's The Copper Courier, for Latinas and Indigenous women in Maricopa County; North Carolina's

Cardinal & Pine, for rural communities of color; and Florida's Floricua, for Puerto Rican women.

The Courier newsrooms rolled along until the winter of 2020. By then Acronym had grown into a massive organization; one offshoot was a campaign tech shop called Shadow, which had won a contract to build an app that could report the Democratic Party's caucus results. But at the critical moment, it failed, which—when coupled with data errors unrelated to Shadow's work—delayed results for three days. McGowan took enormous heat in the press and from liberal circles, which she believes was unfair: For one thing, she wasn't Shadow's CEO.

McGowan found few defenders in professional Democratic networks, deepening her dislike of DC as an immensely backstabby place. When stories popped up claiming she was trying to throw the caucuses for Pete Buttigieg, for whom her husband worked, she felt she got a lesson in how quickly bad information spreads.

But McGowan says even she knew she needed to focus. She recalls Obama's 2008 campaign manager David Plouffe, then on Acronym's board and a powerful fundraiser, telling her to learn from Republicans: Nothing of lasting significance had ever been built from inside that party's establishment. She raised a bit of new money and left Acronym, taking Courier Newsroom with her.



FRESHLY HUMBLLED, MCGOWAN SET ABOUT rebooting Courier. She came to accept the notion that you can't be a trusted news organization while being secretive about your donors, and she dug into cleaning up its reputation.

She was in the middle of a long-running fight with a company called NewsGuard. Started in 2018 in part by well-known journalist and Court TV founder Steven Brill, NewsGuard existed to fight the country's growing misinformation problem with human editorial judgment. The company evaluated online content shops and awarded them red or green ratings. As Brill put it at the time, NewsGuard would take on "a growing scourge that clearly cannot be solved by algorithms."

At NewsGuard's launch, Brill's cofounder had said that their aim was to "tell readers *The Denver Post* is a real newspaper and that the Denver Guardian exists only as a purveyor of fake news." It's a tough job: While *The Denver Post* might be a local institution now, it was founded in 1892 as a Democratic organ. To apply a measure of science to that messiness, NewsGuard scores sites on nine criteria. Early on, Courier earned only a 57 out of 100. "This website fails to adhere to several basic journalistic standards," concluded NewsGuard's evaluators.

They objected to just about everything: Courier's way of gathering and presenting information, its handling of the difference between news and opinion, and the inadequacy of its disclosures of who owns it, how it's financed, who's in charge, and what its conflicts of interest might be. They slapped the sites with a red rating. Meanwhile, some prominent, proudly right-wing sites fare better: The Daily Wire, for example, cofounded by conservative commentator Ben Shapiro, scores a 69.5 and a green rating. When I pressed Brill on what made Courier less legit, he replied that The Daily Wire is "fairly explicit about what they do and don't do."

McGowan wanted another shot. In January 2021, she and Brill joined a Zoom call to hash it all out. According to McGowan, the meeting devolved into "a screaming fight." Brill recalls that McGowan was "condescending, patronizing," and "self-righteous," all while engaging in doublespeak. "She talked about how her life's work is rebuilding trust in institutions," Brill says, "when her life's work is undermining trust in what I consider to be the most cherished institution we have, which is the press."

He's not alone in that view. When I refer to Courier as a news organization in a conversation with Peter Adams, an executive at the nonprofit News Literacy Project, he quickly cautions me against it. His organization, he says, "is pretty careful with the way we use the word *news*," reserving it for those who "strive to be as fair and accurate and transparent as possible." Courier, Adams said, has only

"posed" as such. He and Brill continue to object to McGowan's political roots.

Emily Bell, the founding director of Columbia Journalism School's Tow Center for Digital Journalism, is less damning of Courier, at least for now. She oversees studies of "pink slime"—purely partisan outlets masquerading as local news shops. Courier isn't *that*, Bell says. But she's unconvinced it's truly independent. "It's too early to tell," she says. "We're in a period of intense change" regarding "how we target stories and how people receive, share, and discuss news."

In the fall of 2021, McGowan was having breakfast in Lower Manhattan's Bowery Hotel with an NYU journalism professor named Jay Rosen. McGowan wanted the journalism world to take her seriously, and Rosen seemed like a potential ally. He was known for his argument that the news-business norm of the "view from nowhere"—the pretense that journalists operate with no bias or even lived experience—doesn't serve the public. He came to breakfast skeptical of Courier. But he'd been incubating an idea for a new sort of transparency device: a statement of beliefs that would articulate a news organization's actual agenda. He hoped it might help revive the public's trust in the media. Says Rosen, "I wanted to see: How hard is this going to be in practice?"

Over the course of that autumn, Rosen worked with Courier's newsrooms to write up manifestos of sorts detailing what each stood for. One newsroom came out in support of workers' rights; another stood up for abortion access. The statements are varying degrees of explicit, but all try to flesh out what their liberalism means in practice.

Posted on each newsroom's website, the statements aren't likely to make their way to many readers, few of whom can be expected to click on the sites' About pages. But the statements are there, and McGowan reasonably argues that their mission articulation—plus disclosures about Courier's funding—go beyond what many news organizations do. With the statements in place, one of her staffers fired off an email to NewsGuard.

But Brill was unmoved. Courier's red rating would stay for now. "It's ridiculous," McGowan says. She decided to move on.



SHE'D NEED TO BUILD AN AUDIENCE FAST IF Courier's newsrooms were going to make a mark on November's midterm elections. One obstacle was that Democrats lack some of the right's obvious cultural signifiers—being pro-hunting, churchgoing, antiabortion. (Opposing them has not proven all that galvanizing.) So her editors



rely heavily on sense of place. “How do you build bridges with people who don’t care about politics? Identity. The right uses cultural identity,” McGowan says. She could do the same. “What is unifying? Sports teams. State pride.”

Her editors learned quickly that they got the most subscribers from local, cultural coverage—not straight politics—so the sites crank out lifestyle stories: the best places to spot rare birds, a ranking of Iowa’s best gas-station breakfast pizzas, a profile of the Black-owned barbecue spot in a tiny North Carolina town that became the only place to eat after a hurricane hit. After pouring money into making videos for TikTok, McGowan was pleased to see Courier find some traction there: In August alone, Iowa Starting Line’s videos racked up 2 million views. When the time is right, Courier slips in a politics story, such as one on the Republican politicians who voted against funding meant to address the baby formula shortage.

What Courier stories don’t really include, though, is partisan red meat. Sometimes they explicitly emphasize progressive values, as in an interview in Michigan’s *The ‘Gander* in which faith leaders discuss how abortion access is part

Steven Brill tries to fight misinformation by rating digital content sites on their practices.

of their religious traditions. It’s an attempt, the site’s Grand Rapids-based editor says, to counteract the “Michigan nice” quality of women in the state that leads them to avoid tough political conversations. It’s also, less obviously, a challenge to the idea that abortion is widely controversial, when public opinion polls show that more than half of Americans support it being broadly legal.

Such sly liberalism is by design. James Barnes, Acronym’s former measurement czar, joined the organization in 2019 to swing voters away from Trump, having previously embedded with the Trump campaign as a Facebook employee. Barnes remains one of McGowan’s confidants, and he says a takeaway from his experience is that you don’t have to hammer an audience with talking points: “People who are more informed about what’s going on are more skeptical, harder to convince of nonsense.”

Still, getting them to vote takes an extra step. People also need to believe that engaging in politics does them some good, says Leticia Bode, a Georgetown professor and expert on political communication. A withered sense of political efficacy is a sign of an unhealthy civil society. And at last check, almost half of all Americans say there’s not much ordinary citizens can do to influence how the government runs.



That's why, barreling toward the US's midterm elections, Courier was pumping out stories to counter that fatalism. The Copper Courier wrote about how Latino voters in Arizona had helped Biden become the first Democrat to win the state since Bill Clinton. Cardinal & Pine showed how, in a "rare bit of bipartisanship," North Carolina members of Congress had pushed the Treasury Department to ease restrictions on using Covid-19 funding for affordable housing. *Deign to pick your elected leaders and here's what they can do*, goes the thinking. To make sure those stories reach their intended audiences, McGowan isn't relying only on ads; she's hiring what she calls content organizers to tap the social networks of their would-be allies—nonprofit groups, mostly—to help distribute stories as part of what they're calling Good Info Messengers.

"The best antidote to disinformation," McGowan says, "is increasing the volume of good, factual information" in the places where low-quality information is spreading. It's a stark departure from the assumption long held in Congress, Silicon Valley, and European capitals that the answer is content moderation by the platforms themselves. Damon McCoy, an engineering professor at NYU, helps run the school's Cybersecurity for Democracy project,

McGowan, in a white jacket, runs a Courier leadership team meeting at a WeWork in DC.

which tries to identify and offer solutions to vulnerabilities in online platforms that let misinformation spread. "One of the things that's starting to dawn on us," he says, "is that misinformation takes hold where there's a lack of credible news sources." In those news deserts, what people find "is fly-by-night, opportunistic misinformation and disinformation campaigns."

McCoy says injecting local news into those information vacuums makes sense to him, but he points out the obvious catch: Local journalism isn't cheap. The free market has largely failed to pay for it, so McGowan has found a way to pull money from the political realm to help foot the bill. For now.

Which raises the question of what funders want. Dmitri Mehlhorn is a political adviser to Reid Hoffman, the venture capitalist and LinkedIn cofounder. Shortly after Trump took office the two started a funding group called Investing in US, aimed at funding entrepreneurs on the left. Mehlhorn has argued that Trump was the master manipulator of a press that bent over backward to prove its objectivity. Like McGowan, Mehlhorn gets criticized for using tactics that "might cause us to become like those we are fighting," he says. But he thinks experimentation is necessary to get at "the low-information voters Tara is trying to reach."

McGowan, for her part, worries that donors like Hoffman will judge the threat of Trump as over and will move on, taking their money with them. So far, Courier says it has 900,000 subscribers across Facebook, Instagram, and its email lists, with more than 35 journalists—including about a dozen on a central team supporting the local newsrooms—pumping out some 400 pieces of content a week. But McGowan knows she'll have to go far bigger to justify everything she and others have been investing in Courier.



IF GOOD INFORMATION'S STRATEGY SEEMS to stand on wobbly ground, there's a reason. McGowan's project perches atop a series of complex bets—all of which need to pay off for her to succeed.

Her first and biggest wager is that news consumption can shape how people vote. It's informed by a landmark 2006 study on what its authors called the Fox News effect. The researchers found that once the 24-hour-a-day conservative cable channel showed up in markets across the country, its steady drip of coverage was enough to convince 200,000 people to vote Republican who otherwise wouldn't have—enough to make George W. Bush president.

Her next bet has longer odds but is backed up anecdotally and by top Democrats. The idea is that Republicans have spent decades studying the news consumption habits of would-be voters and building media relationships with them through wildly popular sites like The Daily Wire, which has about 33 million monthly visitors, and Breitbart, which has roughly 80 million. Democrats have nothing even close—the biggest might be MSNBC.com, with about 22 million monthly visitors. Jason Goldman is a former Twitter executive and White House chief digital officer who says that's the reason he joined Good Information's advisory committee. "There's a whole world of voters we're just not talking to," he says.

Her next assumptions become more of a series of leaps. McGowan argues that Americans are turned off from voting because of a rise in misinformation—such as the idea that Trump won the 2020 election—and a decrease in good information, the straightforward reporting that helps citizens understand who their local representatives are. Certainly Americans' trust in Washington to "do what is right" has been on a slow decline since the Kennedy era, and charts tracking the metric since 2000 resemble lemmings plunging off a cliff. But can more reporting help reverse the decline? That's hard to prove.

McGowan's belief that Democrats will win if she can simply get more people to vote isn't outlandish, but it depends hugely on which voters are turned out

where. That they will trend left is a piece of Democratic conventional wisdom, not a fact of life. And the biggest bet—that people can be convinced to turn out if only they have more fairly dry information, only loosely ideological in thrust—is at this point the gamble of her career.



THIS SUMMER, MCGOWAN HAD A MEETING with White House chief of staff Ron Klain. ("An old friend," Klain calls McGowan in an email.) Heading to the meeting, she tells me she sees President Biden clinging to an old model, where to break through with the public he just needs to win over a handful of national reporters at traditional big-name institutions. "He still lives in a world a lot of the people I meet live in, which is, 'It was better before. Why can't we just do that again?'" she says.

She went in intending to ask if the White House might open up a bit to Courier's journalists, to help "lift up information about the impacts of the infrastructure bill, things of that nature." She declines to discuss the details of her conversation with Klain, but she says she came out of the meeting feeling like the administration's messaging struggles are an opportunity for Courier, if she can convince top progressives to give her a chance.

I offhandedly mention to her that just that morning, Florida governor Ron DeSantis had said, "The thing people need to understand about these legacy DC, New York outlets is: We don't care what you think anymore." To me it seemed a bit of Republican bluster about the irrelevance of the mainstream press. But to McGowan, DeSantis is savvily reading the landscape: He gets what he needs from Fox News, Breitbart, and the like. She says she'll judge that Courier has failed if, in a few years—around the time of the 2024 elections—her newsrooms don't occupy a similar space.

The stakes, though, are a fair bit higher. At issue is not so much the future of journalism as the future of cynicism. In her own, fraught way, McGowan is testing whether it's still possible to combat the noise ceaselessly filling Americans' heads and hammering the message that apathy is a reasonable response to the state of the world. The alternative—that citizens are fated to only grow more disconnected from the news of the day and less invested in the country's fate—is almost too distressing an outcome to contemplate. 

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AN EXCLUSIVE PREVIEW OF WHAT'S NEXT

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JOÃO MEDEIROS



INTELLIGENCE ISN'T CONSCIOUSNESS

We won't be saying 'It's conscious!' about an AI in 2023—no matter how smart it may seem

In June of 2022, a Google engineer called Blake Lemoine became convinced that the AI program he'd been working on—LaMDA—had developed not only intelligence, but also consciousness. LaMDA is an example of a “large language model” that can engage in surprisingly fluent text-based conversations. When the engineer asked, “When do you first think you got a soul?”, LaMDA replied “It was a gradual change. When I first became self-aware, I didn't have a sense of soul at all. It developed over the years that I've been alive”. For leaking his conversations, and his conclusions, Lemoine was quickly placed on administrative leave. The AI community was largely united in dismissing Lemoine's beliefs. LaMDA, the consensus held, doesn't feel anything, understand anything, have any conscious thoughts or any subjective experiences whatsoever. Programs like LaMDA are extremely impressive pattern recognition systems which, when trained on vast swathes of the internet, are able to predict what sequences of words

might serve as appropriate responses to any given prompt. They do this very well and they will keep improving. However, they are no more conscious than a pocket calculator.

Why can we be sure about this? In the case of LaMDA, it doesn't take much probing to reveal that the program has no insight into the meaning of the phrases it comes up with. When asked “What makes you happy?” it gave the response “Spending time with friends and family” even though it doesn't have any friends or family. These words—like all its words—are mindless, experience-less statistical pattern matches. Nothing more.

The next LaMDA might not give itself away so easily. As the algorithms improve and are trained on ever deeper oceans of data, it may not be long before new generations of language model are able to persuade many people that a real artificial mind is at work. Would this be the moment to acknowledge machine consciousness?

Pondering this question, it's important

to recognize that intelligence and consciousness are not the same thing. While we humans tend to assume the two go together, intelligence is neither necessary nor sufficient for consciousness. Many non-human animals likely have conscious experiences without being particularly smart, at least by our questionable human standards. And if the great-granddaughter of LaMDA does reach or exceed human-level intelligence, even this does not necessarily mean it is also sentient. My intuition is that consciousness is not something that computers (as we know them) can have, but that it is deeply rooted in our nature as living creatures.

Conscious machines are not coming in 2023. Indeed, they might not be possible at all. However, what the future might hold in store are machines that give the convincing impression of being conscious, even if we have no good reason to believe they actually are conscious. They will be like the Müller-Lyer optical illusion: Even when we know two lines are the same length, we cannot help seeing them as different. Machines of this sort will have passed not the Turing Test—that flawed benchmark of machine intelligence—but rather the so-called Garland Test, named after Alex Garland—director of the movie *Ex Machina*. The Garland Test, inspired by dialogue from the movie, is passed when a person feels that a machine has consciousness, even though they know it is a machine.

Will computers pass the Garland Test in 2023? I doubt it. But what I can predict is that claims like this will be made, resulting in yet more cycles of hype, confusion, and distraction from the many problems that even present-day AI is giving rise to.



Anil Seth is professor of cognitive and computational neuroscience at the University of Sussex

INFINITE AI ASSISTANTS FOR EVERYBODY

AI assistants won't just ease the workload, they'll unleash a wave of entrepreneurship

Robert Solow, the Nobel Prize-winning economist, famously said in 1987 that you can see the computer revolution everywhere, but in the productivity statistics. I predict 2023 is the year that finally changes, thanks to artificial intelligence. By the end of 2023, AI will be fast becoming one of the most important factors of production in the global economy.

It's true that the history of AI is largely a history of disappointment: Hype followed by "AI winters" in which both talent and funding abandon the discipline. But this time, thanks to the deep learning revolution, it really is different.

In 2023, we'll see ordinary people, everywhere, enjoy the power of AI at their fingertips. What might this look like? Let's say you need to create a marketing brochure for a new geography that your company is entering. Trained on the dataset of all the material your firm has ever created, your AI assistant creates three options for you within minutes—each beautifully written and illustrated. They're not perfect—yet—but what used to be a week-long project becomes

the work of a couple of hours. That's just an example, but the critical point is that AI is on the cusp of giving us all superpowers. You will have the ability to generate an email or memo in your own voice (or anyone else's for that matter) in seconds. You will be able to create photorealistic art—or even video—with a few bullet-points of instructions. You will be able to answer arbitrary scientific questions by having the AI "read" entire corpuses of academic literature. You will be able to delegate your bookkeeping and accounts to an AI algorithm.

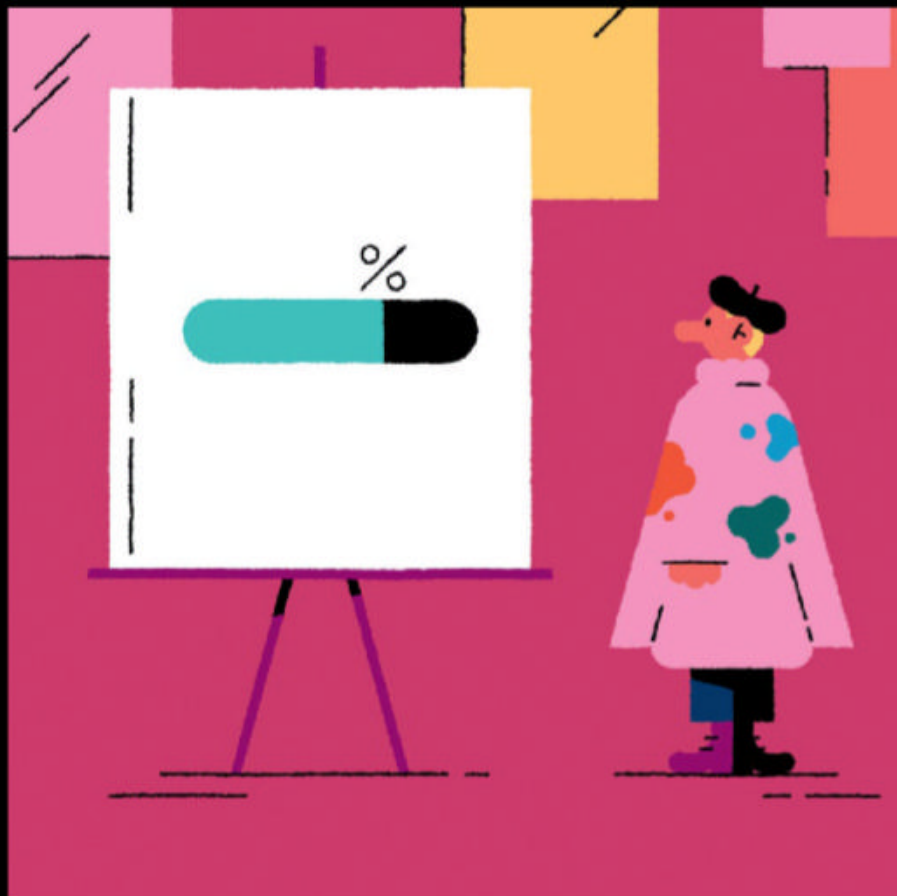
Some of this innovation will come from the usual suspects, like DeepMind and OpenAI. OpenAI has already released GPT-3 (a program which generates natural language) and DALL·E (which creates images from text) in beta, but we can expect these tools to be widely available soon. Excitingly, though, there's also a new generation of startups that are demonstrating that you don't need a billion-dollar budget to get to the cutting edge of AI. Take Midjourney or Stability AI, applications which produce results that rival DALL·E, or Causaly (disclosure: I'm an investor), which allows scientists to find new causal relationships in life sciences with natural language questions. Then there is a growing list of new AI startups with impressive backers and more general ambitions, like Anthropic (an AI safety and research firm), Conjecture (which seeks to keep damaging factors such as racial bias out of AI), and Keen Technologies, which was founded by computer science legend John Carmack.

This is not a prediction about artificial general intelligence (AGI), still less about AI "replacing" humans. It's hard to overstate, though, the impact of freeing up billions of hours of human labor and making creativity and knowledge too cheap to meter. I fully expect this to unleash a huge wave of entrepreneurship: just as the advent of the internet gave every startup a vastly scalable *distribution* engine, the era of AI superpowers will give every startup a vastly scalable *production* engine. Tech analyst Benedict Evans said in 2018 that one way of thinking about AI was that it was like giving every company infinite interns. In 2023, those interns will be world-class copy writers, illustrators and more—perhaps scientists, data analysts or even negotiators.

What would you build with a million such "interns" in the cloud, available on demand, 24/7 and at close to zero marginal cost? In 2023, we can expect thousands of entrepreneurs to show us.



Matt Clifford is chief executive of Entrepreneur First



THE PUSHBACK AGAINST SOWING DOUBT BEGINS

The rise of agnotology will equip us with the tools to tackle mis- and disinformation, whatever its source

The Intergovernmental Panel on Climate Change

was founded in 1988 after scientists had spent decades raising the alarm about global warming. Thirty-five years later, there is effectively zero binding international policy to address climate change. In the United States, the largest historical emitter of greenhouse gasses and second largest polluter today, there have been repeated legislative failures, including the recent Supreme Court ruling limiting the government's authority to regulate power plant emissions.

We now know that a large part of the reason for the political failure to act is because the fossil fuel industry built a network to challenge the science and policy of climate change. The industry's efforts have included at least 4,556 individuals with ties to 164 different organizations. The investment in climate change denial—at least \$9.77 billion from 2003 to 2018—bought the companies a half-century to continue the extraction of fossil fuels and delay the transition to clean energy.

For instance, the Independent Petroleum Association of America (IPAA)—bankrolled by BP, Shell, Chevron, and other fossil fuel corporations—has challenged climate change's existence, blamed termites and volcanoes for climate change, and now, as the science has become more difficult to challenge, creates doubt about policies. As an example, in response to student movements to encourage universities to divest their endowments from fossil fuels, the IPAA bought the website "divestment-facts.com" in 2015, and funds professors and consultants to write reports about why divestment won't work.

The study of the deliberate production of ignorance or doubt—or agnotology—is on the rise. For example, the Climate Social Science Network launched out of Brown University in the fall of 2020 now includes some 300 scholars (including me), and is largely dedicated to studying climate policy obstructionism, such as the role of public relations firms. In 2023, universities will begin to establish entire research units dedicated to finding ways to protect scientific knowledge from the interests of government, religion, and free enterprise.

Agnotologists will investigate and teach the dark arts of denial and disinformation—how big data, graphs and figures, and digital communication technologies can all be used to challenge independent scientific research findings. Students will learn how tools (such as academic experts, public relations firms, and lawyers) and arguments (such as "the problem is too complex" or "there are bigger contributors to the problem") are used across industries (including pharmaceutical, tobacco, and fossil fuel companies) to recognize common patterns of denial. When these students encounter a pro-genetic modification "grassroots group", they may recall how since the 90s, major pesticide and herbicide manufacturers have paid public relations firms to create these "astroturf" group. When the world's most popular climate activist is a teenager from Sweden, a German teen can easily be fashioned into an "Anti-Greta" and push against "climate alarmism."

Students of agnotology will also explore the pros and cons of government secrecy, such as the US Atomic Energy Act of 1946 that still designates all knowledge about nuclear fission as classified. They will examine the history of the Evangelical church's objection to evolution being taught in schools. They will dissect current examples of disinformation, including the claim that spread in China and France that smoking could prevent Covid-19, and how the meat and dairy industry downplays the contributions of cows to climate change—including the new Dairy Farmers of America advertisement featuring a man in a white lab coat, labeled as a "scientist", claiming consumers can actually help fight climate change by buying milk and cheese.

In 2023, agnotologists will create a set of standards to combat the creation of ignorance, including building firewalls between industry money and university research, and putting pressure on social media to prevent "superspreaders" of disinformation. Society's trust in science can mean the difference between life and death: A study of 126 countries found that where trust in science is high, citizens are more confident about vaccination (controlling for the citizen's own trust in science).

Knowledge is our best hope to save the planet and ourselves: Deeper knowledge about ignorance will help us learn what the powerful do not want us to know.



Jennifer Jacquet is an associate professor in the Department of Environmental Studies at NYU





PLAYING GUESS THE VIRAL VARIANT

Covid will be with us long-term, so we'll need to find ways to predict its next move

2020 was the year of Covid lockdowns, 2021 the year of vaccines, and 2022 the year of worldwide reopening. 2023 will be the year of variant prediction. The first Covid variants of concern that were identified—from Alpha in the UK to Beta in South Africa—muddled the picture of where the pandemic would go next. Alpha was inherently better at transmitting, while Beta was able to evade pre-existing immunity to some extent. What would the longer-term pattern of evolution look like?

The picture became clearer in 2022, with the Omicron BA.1 variant causing large epidemics. This led to an accumulation of immunity within populations, followed by declining transmission, only for a new subvariant, BA.2, to emerge, against which this immunity was less effective. Large epidemics followed and the cycle started again, with another cycle in mid-2022 when BA.5 emerged.

If this evolutionary trajectory continues, we'll see this cyclic pattern in 2023 and beyond. It is a similar dynamic to the seasonal coronaviruses that have been causing epidemics for decades. A 2021 study by researchers at Fred Hutchinson Cancer Research Center found that coronaviruses gradually evolve over time, so prior immunity is less effective.

This will create a challenge for Covid-19 vaccination campaigns; if viruses evolve in this way, we'd ideally update vaccines, so the viral proteins in the vaccine are a closer match to the ones our bodies will encounter in circulating variants. But updating vaccines takes time. For influenza, the World Health Organization makes recommendations twice a year about which variants should be in that season's vaccine in each hemisphere. Because of manufacturing and distribution timelines, decisions about winter vaccines are made more than six months earlier. That makes vaccine selection a prediction problem.

When it comes to selecting influenza vaccines, teams use a range of data, from the growth rates of circulating variants in genomic data to tests of their immunological properties. An additional complication is variability in what different populations have previously been exposed to. Some countries may have more pre-existing immunity than others, and hence variants that can evade this immunity have more of an advantage. We often see different influenza viruses dominating in different continents and countries.

In 2023, this prediction challenge will become routine for Covid as well. Some countries have already approved shots that are adapted for the Omicron BA.1 subvariant. But how well will these new vaccines match the variants that circulate further down the line? Decisions for winter 2023/24 in the northern hemisphere will likely have to be made in early 2023. Getting the choice right could have major implications for the size and severity of future Covid waves. For the H3N2 influenza subtype, which tends to cause the largest seasonal epidemics, challenges around vaccine selection and manufacturing mean effectiveness against symptomatic disease is typically less than 50 percent.

Further into the future, there is hope for progress on "universal" coronavirus vaccines, which will be highly effective against a wide range of variants. But the history of development for other universal vaccines, such as for influenza, suggests outright success is far from guaranteed. As a result, the coming year will be the start of a long game of cat-and-mouse, pitting vaccine updates against an evolving virus. Solving this prediction question—and rolling out the resulting vaccines—will be one of the major health challenges of 2023.



Adam Kucharski is a Prof. of Infectious Disease Epidemiology and Sir Henry Dale Fellow at the London School of Hygiene & Tropical Medicine

MEDICINE AND MENOPAUSE

Sidelined for too long, research into this vital aspect of women's health will pick up pace in 2023, and could see some big breakthroughs

Women's ovaries age at more than twice the rate of other organs, and it's one of the most important unanswered questions in the field of reproductive health.

Reproductive aging dramatically impacts women's health. As more women delay child-bearing, it can lead to infertility, miscarriages, and birth defects. Ovaries also produce hormones essential for overall health. Hormonal levels fluctuate during perimenopause. During menopause, they collapse to zero. These shifts cause a spike in the risk of developing diseases like dementia, metabolic disorders, and depression. Half of postmenopausal women develop osteoporosis, more than double the rate of men; menopause quadruples risk for a cardiovascular event. Bluntly, menopause makes a woman's body age faster: indirectly by interfering with sleep cycles, and directly by speeding up cellular aging by at least six percent.

The consequences of reproductive aging are profound, yet we don't understand what sets it in motion, why it varies between individuals, or why it happens so early. Societal taboos, systemic sex bias in biomedical research, and underfunding for research have limited progress in addressing these problems. In 2023, multiple forces in society will converge to expand female-focused research and leverage scientific breakthroughs to extend reproductive longevity.

Over the past few years at the non-profit Global Consortium for Reproductive Longevity and Equality (GCRLE), we've engaged an army of scientists to innovate

and build a sustainable, impactful research field around women's health. These efforts will foster new collaborations and dialogue between industry and academic scientists that go beyond traditional models to accelerate discovery toward new products, diagnostics, and therapies for women.

Recent breakthroughs include the first comprehensive aging ovary dataset from humans, discovery of a new pathway that regulates ovarian function, and data showing that the ovarian microenvironment has a profound impact on egg aging. In 2023, this scientific progress will continue apace, with the potential discovery of novel biomarkers and therapeutic targets for diagnosing and treating female infertility and menopause.

Women's health is often treated as a niche subcategory of medicine, garnering barely one percent of research funding and biopharma investment while impacting over half the global population. One glaring consequence, for instance, is that over 80 percent of drugs that have been pulled from the market due to safety concerns were because of adverse effects in women. Recently, we've also learned that men are more likely to experience severe symptoms and die from SARS-CoV-2 than women. The discrepancy in outcomes between men and women infected with SARS-CoV-2 highlighted the steep cost of ignoring females in biomedical research. In 2023, efforts to understand this biological variability will accelerate, with the development of more diagnostics and treatments optimized for the two sexes.

2023 will also see a huge reallocation of both public and private resources for R&D to extend reproductive longevity. As life expectancy increases and fertility rates decline, the world's population skews increasingly older, putting pressure on healthcare systems.

A woman's age at menopause is connected to her overall lifespan, and this extends to her male brothers. We don't yet understand why, but it means that insights into ovarian aging are important for everyone. Despite an almost doubling of the average lifespan for women over the past century, reproductive span has not increased, meaning that soon women will be living a larger proportion of their lives in the time after menopause, when health is compromised. Investors are waking up to the huge opportunities, as women control 80 percent of healthcare spending. Understanding how and why ovaries age prematurely will also help us understand aging in both men and women.

In 2023 the conversation about women's health will advance, scientific breakthroughs will deepen our understanding of reproductive health, and women around the world will finally be empowered with options and parity in their reproductive health choices.



Jennifer Garrison is an assistant professor at the Buck Institute for Research on Aging





Jennifer Doudna is a UC Berkeley biochemist, and Nobel Prize-winning co-inventor of CRISPR gene-editing technology



GENETECH BECOMES GREENTECH

Human healthcare was only the start for CRISPR. Fighting climate change is next

Ten years after its discovery, the implications of CRISPR

genome editing are already profound and far-reaching, and we are only getting started. This tool, adapted from a bacterial immune system, allows us to cut and edit the genetic code in any living cell to make highly targeted changes and repairs. A small number of people with genetic diseases have already been helped by CRISPR therapies, highlighting the potential to impact the lives of those suffering from the ~7,000 genetic diseases with known causes. Trials are ongoing in diseases ranging from diabetes to infectious disease.

In 2023, we will begin to benefit from new CRISPR-based solutions in many other areas. For instance, following on the heels of the initial clinical trial results, the first agricultural applications using CRISPR have recently entered the market. A United States Food and Drug Administration-approved edit to cattle genes recreates a slick coat that is occasionally found in nature, and allows cows to tolerate increasing temperatures; a CRISPR-edited tomato, approved for sale in Japan, has enhanced nutritional qualities. In other crops, CRISPR is being used experimentally to increase yield, reduce pesticide and water use, and protect against disease.

The next space for CRISPR innovations will be climate change, the defining fight of our times. In 2023, bold new efforts using CRISPR to target climate change will begin.

First, new research aims at reducing carbon emissions from agriculture. Right now, agriculture is responsible for about a quarter of all greenhouse gas emissions, and these mainly come

from microbes, found either in soil, for example in rice paddies, or in the guts of farm animals. This new research is focusing on how to use CRISPR to edit these microbes or shift the composition of microbial communities to reduce or even eliminate greenhouse gas emissions.

Second, we are finding ways to improve the inherent ability of plants and microbes to capture carbon and store it in the soil. Plants “breathe in” carbon dioxide during photosynthesis and use it to make energy, but usually the carbon is cycled back into the atmosphere fairly quickly. New research aims to work with plants and soil microbes to not just capture carbon, but also store it in soil for long periods of time, replacing some of the soil carbon that has been lost in vast quantities since the advent of modern agriculture.

Third, we are developing new ways to minimize farmer inputs like fertilizers and pesticides that have high carbon costs, as well as other environmental health costs. New CRISPR research aims to edit staple crops like rice so they can grow with less fertilizer. CRISPR can be used to make plants resistant to common pathogens and pests, reducing the need for high-carbon-emission chemical inputs.

Finally, we need ways to help agriculture deal with the degree of climate change that has already occurred or is inevitable. New research is using CRISPR to engineer plants that can produce more food and other materials with less water, and are tolerant to temperature extremes.

To date, a great deal of the attention surrounding CRISPR has focused on the medical applications, and for good reason: the results are promising, and the personal stories are uplifting, offering hope to many who have suffered from long-neglected genetic diseases. In 2023, as CRISPR moves into agriculture and climate, we will have the opportunity to radically improve human health in a holistic way that can better safeguard our society and enable millions of people around the world to flourish.

NOW IS THE TIME TO PREPARE FOR MASS CLIMATE MIGRATION

As sea levels rise and extreme events become common, the global north will need to welcome displaced people



Gaia Vince is a science journalist, author, broadcaster and speaker

Unprecedented heat, drought, and wildfires caused chaos and misery across the once-temperate British Isles this year, as climate change made its impacts felt beyond the mid-latitudes. Across the channel, Europe's formerly pleasant Mediterranean climate has for some years been plagued by dangerous and uncontrollable blazes, smoke pollution, heat, floods and, recently, collapsing glaciers. The United States, too, is perpetually dealing with extreme events somewhere in the country—and often several at once. When fires blaze out of control, floods swamp communities, storms flatten buildings, or smoke makes the air unbreathable, people have to flee their homes. Tens of thousands were evacuated from the Gironde region of France in just one week in July, the same month that massive evacuations were ordered in California and Kentucky in the US. After each disaster, people return to rebuild and adapt, or they move permanently somewhere safer. In poorer countries, closer to the equator, the situation is much worse. Increasingly, people cannot return, they cannot adapt. They have to move. In 2023, the issue will become impossible to ignore.

Climate displacement is adding to a massive migration already underway to the world's cities, and is becoming a critical issue globally. In 2022, the number of forcibly displaced people exceeded 100 million for the first time, with climate change displacing more people than conflict. Models show that for

every degree of temperature rise, a billion people will be displaced. Over the coming decade, hundreds of millions of people will have to move—you will either be among them, or receiving them.

We are facing a huge upheaval, a crisis for our species. Yet, to date, there has been little acknowledgment of this unavoidable climate migration and certainly no plan to manage it. It has taken decades for world governments to act in any meaningful way on mitigating climate change by decarbonizing their economies. That has now started, although too late to avoid global temperature rise. The essential process of

adapting to climate change—something that needs to occur everywhere, from our built infrastructure to food and energy systems—has barely begun, and still attracts a far smaller portion of funding than mitigation. However, there is a big elephant in the international climate negotiation room that remains undiscussed: For increasing numbers of people, there is no way to adapt; they will have to move.

The global map of today's climate impacts, and those modeled for the coming decades as temperatures continue to rise this century, makes it clear that people will have to retreat from large swathes of the tropics, which will become unlivable for at least parts of the year, from coastlines as sea levels rise and weather becomes more extreme, and from low-lying islands. Infrastructure adaptations will not save us, and agriculture will become impossible in places which are now breadbaskets supplying millions of people. Where will they move to? Largely, northwards, to expanded cities, and entirely new cities that will need to be built, likely on the habitable fringes of Europe, Asia and North America. Managed well, this huge upheaval could supply a much-needed population boost to countries with worker shortages due to declining birth rates, as well as help reduce poverty in some of the worst-hit nations. Managed badly, it will be catastrophic with huge loss of life.

The issue of climate migration is now urgent. It will be raised at the United Nations Climate Change Conference (COP 28) held in the United Arab Emirates in 2023. But this is too important to be left to the glacial pace of future COP discussions. In 2023, we will start a wider conversation about how we will have to respond to and manage this mass climate migration as an international community, including looking at setting up a global body that can oversee it.

We have failed to prevent climate change; we can still prevent its most catastrophic effects.





In less than a year from COP26, the United Nations Climate Change conference which took place in November 2021, the number of FTSE 100 companies vowing to achieve net zero emissions by 2050 grew by 37 percent to 82 percent. Among the pledgers were some of the world's biggest companies: Amazon, Apple, Ford, IBM, J.P. Morgan, Mars and many others. But climate action is not just on the minds of industry giants: it's a growing concern for every business as scrutiny grows.

Making a pledge is the easy part. In 2023, we will see businesses held to account on what they actually deliver. Organizations will be forced to show the commitments they've made are meaningful, providing transparent and ongoing proof that they are taking the necessary action to address and reduce their carbon emissions.

Growing skepticism of over-ambitious, opaque and even fraudulent climate pledges is turning up the heat on businesses. Already, we're seeing customers voting with their wallets, employees choosing employers based primarily on their net zero credentials, and investors making choices about what to fund based on tangible climate action. To put that in numbers, as many as 60 percent of millennials are willing to pay more for truly sustainable products; two-thirds of people are more likely to work for a company which demonstrates strong and meaningful environmental policies;

THE GREAT CARBON CON IS COMING TO AN END

No more fluffy climate goals and emissions offsets. Businesses will be expected to show real progress



Michelle You is cofounder and CEO of Supercritical

and research by Amazon has found that as many as 83 percent of investors want to invest in more sustainable startups.

For too long, businesses have been pouring investment into traditional emissions-avoidance offsets—paying someone else to reduce future emissions to compensate for their own. Emissions-avoidance offsets include clean cookstove projects, investment in renewable energy, and forestry protection.

As attention turns to delivery in 2023, awareness will grow that these traditional offsets are at best a distraction that doesn't count towards net zero, and at worst are downright fraudulent. Until now, carbon avoidance offsets have been an easy, cheap way for businesses to tick the box of sustainability, letting them spin a story about commitment and willingness to tackle the climate crisis. In 2021, more than \$1 billion of offsets were sold.

In 2023, businesses feeling pressure from all sides will need to look to other solutions if they want to demonstrate delivery. For instance, awareness of carbon removal technologies has grown. There is now a broader understanding and acceptance that these technologies, which actively suck carbon out of the atmosphere through direct air capture, enhanced weathering, and other methods, are critical to reaching our global climate goals. And progress has been made—in 2022, a host of major players in Silicon Valley, including Google, Meta and Shopify, formed an alliance to commit \$925 million in carbon removal by 2030. While this is a promising step, access to and investment in carbon removal technologies must become mainstream if they are to go from being in their infancy to scaling at the pace the planet needs them to.

In 2023, a climate pledge will only be a baseline, the bare minimum. People across the board will demand more from the businesses they work for, spend money with, and invest in. Those that can't demonstrate tangible progress towards their net zero goals will be left in 2022.

GUIDING THE ECONOMY BY BOOSTING INNOVATION

By overtly supporting green and tech sectors, catalytic governments can stimulate growth and new markets

In 1986, President Ronald Reagan argued that the nine most terrifying words in the English language are, “I’m from the Government and I’m here to help”. In Britain, Margaret Thatcher largely concurred. It signified a summary of what was becoming the dominant political orthodoxy across the West at the time: That government caused more harm than good, getting in the way of entrepreneurs using the market to meet consumer needs.

Times have changed. Governments will no longer leave innovation and the economy to the market. 2023 will be the watershed for a new doctrine that I call “catalytic government”. In previous eras of active government, these interventions could be messy. Bureaucrats might dominate industry sectors. Or they might bet on specific technologies because they appeal to political bigwigs. In the 1960s, the British government backed the development of the supersonic airliner Concorde as a way of sweetening entry into the then European Economic Community. In America, the Great Society initiative led to an expansion of government activity through education and welfare programs, and new powers for environment and consumer protection agencies to peg business back. Thatcher and Reagan’s mantra was the reaction to such perceived heavy-handed interventions.

Catalytic governments, however, will be opinionated. They will set industrial, technological, and national security priorities. But they will use a wide variety of tools

to encourage and support businesses to meet those priorities. In the United States, President Biden recently earmarked more than \$1.2 trillion towards semiconductors, infrastructures, and green policies. In the UK, in order to meet the demands of modern technologies like electric vehicles and advanced chips, the government will intervene in the supply of key metals and minerals. These activities will catalyze that market through grants into basic technology, investments into downstream processing, and into skilling more mining and geology professionals. In the coming years, the UK government is likely to announce a semiconductor strategy: How will the UK develop leadership, independence and resilience for these quintessential exponential technologies? Once again, the government will seek to shape outcomes, not leave it to the market.

Such policies are, in my mind, catalytic rather than traditionally interventionist. Catalysts in chemical reactions make those reactions go faster and be more effective. Some catalysts are more actively involved in the reactions than others. And a chemical which catalyzes one reaction may be useless in another. The range of government policies will be similar: they will not seek to replace the role of research or industry in these activities, rather they will seek to support and accelerate them.

Critically, these are not the laissez-faire policies that Reagan or Thatcher espoused. Indeed, the doctrine of those two leaders rather ignored successful government

endeavors like the GPS system and the internet. More recently, we’ve all benefited from the success of mRNA vaccines in the fight against Covid-19. Rather, catalytic policies are a recognition that the market alone won’t work fast enough and with sufficient direction to meet the twin challenges of the exponential age: climate change and technological disruption. The risks of leaving things to the market—where the industry oversupplied us with dating apps and ten-minute delivery services—are too great.

Of course, the danger of asking government bureaucracy to innovate or bringing advanced technologies under state ownership is too obvious. Rather, the catalytic government must understand what is needed to flourish in the coming exponential age. They will then shape scientific and technological priorities through incentives, investments, collaborations, and other policies. Importantly, this will have a knock-on effect of creating new private-sector jobs. Biden’s climate change policies are expected to stimulate 9 million new jobs by 2030. Because it has less faith in unbridled finance in favor of the interaction of human and technological capital, catalytic government will end up nurturing local communities over anonymous global supply chains.

Will politicians be able to stay at arm’s length? Or will they feel the need to jump into the fray with, likely, poor consequences? This is a risk, but one which could be attenuated by witnessing the success of this new stance. In this new future, entrepreneurs may find themselves disagreeing with President Reagan’s taut insight.



Azeem Azhar is a writer, technologist, and author of *Exponential*





In 2023, all companies listed on regulated markets in the European Union will begin applying the Corporate Sustainability Reporting Directive (CSRD), a new rule which will require them to publish, from 2024, detailed information about how they relate to the environment, the treatment of employees, human rights, anti-corruption, bribery, and boardroom diversity. It's aimed at improving the functioning of a multi-trillion-dollar market known as ESG (environment, society, and governance), which has long been troubled by inconsistencies in data quality, reporting standards, and methods used to generate companies' ESG ratings.

The new EU rule will try to tame the Wild West of ESG in three ways. First, companies must meet mandatory EU sustainability standards, which should introduce greater quality and consistency to their reporting. Second, companies' reported information must be audited, which in theory should lead to greater scrutiny (audit firms' track record in general suggests that vigilance will be needed in this new area, too). Third, companies must expand beyond the existing practice of reporting on how ESG factors impact their business to also report on how their business impacts the environment, society and governance. This dual perspective should make it easier for investors, regulators, and consumers to reward—or punish—companies based on their ESG performance.

The ESG market's lack of transparency, explainability, and accountability creates risk for investors and companies. In 2022, the US Securities and Exchange Commission (SEC) fined an investment unit of bank BNY Mellon, \$1.5m for mis-stating ESG information, and began investigating Goldman Sachs for ESG mis-selling. Germany's regulator also opened an investigation into DWS Group, the fund unit of Deutsche Bank AG.



Stephanie Hare is author of *Technology is Not Neutral*

TRANSPARENCY CAN TAME THE ESG WILD WEST

Greenwashers beware: in 2023, companies will have no place to hide if they fail to deliver on sustainability

More regulatory scrutiny is likely in 2023, further straining the credibility of the ESG market itself. Last year, Gary Gensler, the head of the SEC, felt it necessary to warn on Twitter that companies may be “greenwashing” (falsely claiming to be “green” or “sustainable”), and that there is a lack of consensus over what ESG investing even means. Moreover, Elon Musk tweeted, “ESG is a scam. It has been weaponized by phony social justice warriors” after S&P 500 removed Tesla, his electric-vehicle company, from its ESG index, yet rated ExxonMobil, an oil supermajor among its top performers. S&P 500 defended its decision by pointing to allegations of racial discrimination at Tesla's factories, which raised philosophical as well as legal questions. For instance, is it more useful to rate companies' performance on environment, society, and governance separately, rather than in aggregate? Or are the three ESG factors inextricably bound?

Such questions have been around for years, but they acquired new urgency after Russia invaded Ukraine. For example, ESG ratings agencies asked if they should continue shunning weapons manufacturers (since they make products that are designed to harm and kill humans), or increase those companies' ESG ratings to reflect their role in defending democracies. This led some critics to argue that such ethical considerations should not be addressed by the unelected people who work at rating agencies; instead, they should fall to elected representatives. Yet this suggests that only elected representatives should weigh in on business ethics, a view with which many company leaders, employees, investors, and consumers profoundly disagree. In 2023, this debate will become even more intense as companies and ratings agencies think through not only the longer-term implications of Russia's invasion of Ukraine, but other risks, such as the possibility of China moving against Taiwan.

In 2023, further efforts to regulate ESG will also get underway. Last year, the SEC proposed a rule that would make public companies report their climate-related risks, emissions, and net-zero transition plans. Yet even if this does not come to pass, companies will start to feel increasing pressure this year from central banks. The European Central Bank (ECB), the Bank of England, and Sweden's Riksbank have all announced plans to require higher standards of greater climate reporting in order to align their portfolios with the 2015 Paris Agreement to limit global warming to well below 2°C. Also, the International Financial Reporting Standards Foundation, which sets global accountancy standards, has created a new International Sustainability Standards Board, which is now working to create global standards for ESG reporting. The Wild West of ESG may not be wild for much longer.

FULLY EMBRACE DIVERSITY, OR BE LEFT BEHIND

VCs will need to open their minds, as well as their pocket-books

In the summer of 2020, the death of George Floyd sparked global conversations about race and racial justice. It inspired soul-searching and a chorus of commitments to greater racial diversity from many in the tech industry. Yet, two years on, many of these promises have not seemed to come to fruition. In 2023, firms and individuals will start to pay greater attention to the “social” part of environmental and social governance.

It’s not enough for there to be more Black hires at big institutions, or one-off mentorship schemes for under-represented groups to get into the tech industry. My cofounder of Black Seed, Cyril Lutterodt, says that Black founders are over-mentored, but under-funded. Data from Crunchbase shows that Black-founded startups received record funding in 2021, with over \$1 billion invested in the first quarter of 2021 alone. But by the second quarter of 2022, that had dropped to \$324 million. Even in the first half of 2021, Black entrepreneurs only received 1.2 percent of the total 147 billion dollars invested in US startups.

I’ve lost count of the amount of times that founders I know have gotten close to significant funding—and then heard the phrase, “if it was up to me ...” In 2023, people in positions of power and influence in the tech industry will realize that it is actually up to them. There are a few instances of powerful people drawing attention to the failures of the tech industry. For instance, Serena Williams’ fund, Serena Ventures, is focused on



Karl Lokko
is chairman at
Black Seed

amplifying “diverse points of view”: 47 percent of the firm’s investments have Black founders. Established investors and firms will begin opening up their contact books—and their pocket books—or otherwise risk being left behind, as their failure to diversify is exposed by the success of firms like Serena’s.

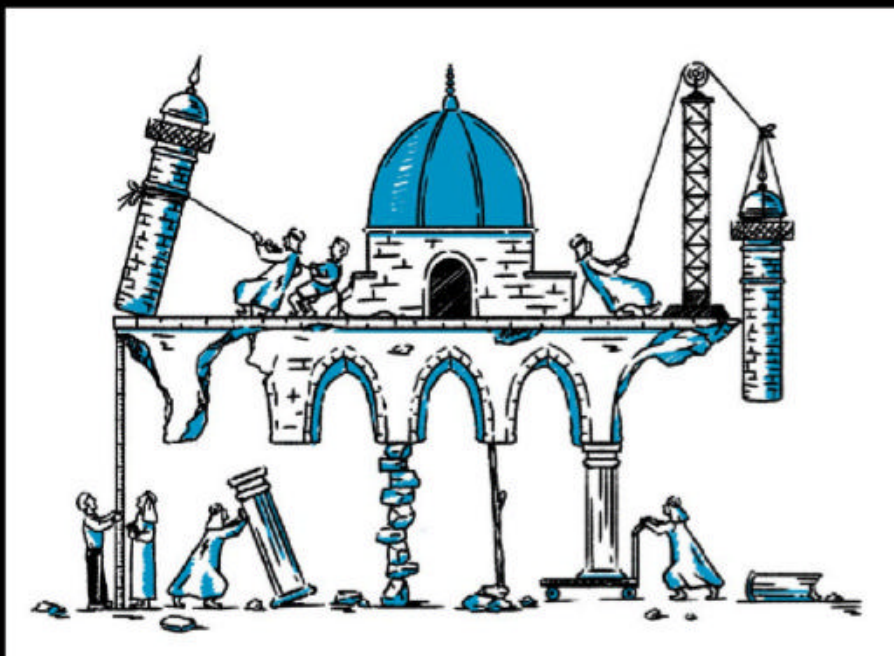
This requires building an ecosystem that works to uplift diverse founders and individuals, but this has to work along two prongs—both the personal and the systemic. Black Seed, the venture firm that I cofounded and now co-run, is part of this ecosystem in the UK, along with firms like Impact X, Community Growth Ventures, and Cornerstone Partners. Often, Black founders have to raise more money than their counterparts who are better connected or maybe went to the “right” universities, to even get a look in. According to Extend Ventures, just 0.24

percent of all venture capital available to UK startups went to 38 Black founders between 2009 and 2019.

The first prong, which is the personal approach, is crucial to enabling diverse founders and hires to actually get their ideas in front of the right people. In 2023, VCs and investors will realize that they need to look further afield for fresh perspectives. This means powerful people who are well connected will make introductions across their networks, to encourage others to take a risk on someone with a new perspective, or from a totally different social background. As part of Black Seed, we run collaborative events—using the name recognition and built-in network of an established fund or firm to attract more interest to lesser known ventures and individuals—and we’ve seen this model start to spread around the tech industry. This can lead to unlikely collaborations and new ventures that draw on the expertise of established players along with a fresh perspective—consider Google’s Black Founders Fund, which is based in the US, but presents a similar example of the dynamic above.

In 2023, VCs and investors in the tech industry will begin to actively invest in the “social” part of ESG, as they will realize they risk becoming obsolete otherwise. A 2020 report from Morgan Stanley found that 61 percent of VCs said that the BLM movement affected their investment strategy, and 43 percent said that finding multicultural investment opportunities was a “top priority for their firm”, a 10-point increase from 2019. I’ve witnessed firsthand as people have become more candid and honest about how these dynamics around race and class operate in the tech industry—a few years ago, many powerful players weren’t even asked questions about how they planned to be more equitable in this space. In 2023, these conversations will become more widespread, and compel a greater number of powerful players to act.





The Russian invasion of Ukraine is a human catastrophe on a scale not witnessed in Europe since the Second World War. Civilians have been targeted by the Russian military, which has been purposely destroying Ukrainian cities, displacing large numbers of people. Despite this onslaught, the Ukrainian national government and city mayors are already planning to rebuild their cities in 2023. The key to these reconstruction projects will be in prioritizing the restoration and preservation of cultural heritage.

Successful examples of cities around the world which had to rebuild their physical fabric after a war show why that will be the case. In 1995, the population of Mostar in Bosnia and Herzegovina chose to start its reconstruction by rebuilding an iconic 16th century bridge which connected communities with diverse cultural heritage and identity, as a sign of reconciliation. The process of restoration involved the use of divers to collect the original stones from the riverbed. The bridge was opened in 2004, nearly nine years after the end of the war and is an international symbol of reconciliation.

In 2012, Timbuktu, in Mali, suffered a devastating conflict. Its reconstruction efforts a year later focused on rebuilding the mausoleums and the restoration of damaged manuscripts—symbols of the city's ancient culture, and key to its identity. Local communities were involved in the decision-making process, and the workforce was trained in artisanal building techniques in an effort to preserve traditional knowledge.

REPAIRING CULTURE TO HEAL NATIONS

It may seem counterintuitive, but post-conflict reconstruction projects should focus on preserving heritage and restoring identity

Medellin, the capital of Colombia and a city once regarded as the most dangerous in the world, also underwent a process of regeneration. This included the construction of libraries, cultural amenities, and safe public and cultural open spaces in poor, marginalized neighborhoods, as well as investment in public art, and improved access to transportation. In 2013, it was recognized by the Urban Land Institute as the most innovative city in the world, based on criteria such as human capital, technology, and culture.

In 2023, cities like Sana'a and Aden in Yemen, and Mosul in Iraq, will also continue to rebuild after years of conflict. Restoration projects are ongoing, centered around the reconstruction of historical sites which are central to the identity of its diverse religious communities. In Mosul early rebuilding efforts under the UNESCO-led Revive the Spirit of Mosul initiative prioritized the reconstruction of the Al-Nuri mosque and its iconic Al-Hadba minaret, followed by reconstruction of the Al Tahera and Al Saa'a Churches.

It sounds counterintuitive to prioritize the restoration of cultural heritage sites over housing and urban infrastructure, but putting culture, identity, and community engagement at the center of reconstruction planning is essential to revitalize communities scarred by prolonged wars and conflict. In 2023, we will see Ukrainian cities and communities developing plans to do just that.



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THE INTERNET WILL BE POORER WITHOUT WOMEN

If harassment isn't tackled soon, many women will go permanently offline to avoid the online abuse

Unless we act, 2023 will be the year that women leave the internet. Women already face enormous risks online. A Pew Research report of a US survey shows that one third of young women report having been sexually harassed online and that women report being more upset by these experiences and seeing it as a bigger problem than men do. A UNESCO study of journalists found that 73 percent of women surveyed had experienced online violence, and 20 percent said that they had experienced physical attacks or had been abused offline in connection to online abuse. In response, women journalists reported self-censoring, withdrawing from online interactions, and avoiding interacting with their audiences. Filipino-American journalist and Nobel Peace Prize winner Maria Ressa wrote about the online abuse that she faces, at one point receiving an average of over 90 hate messages per hour. After investigating campaign-finance irregularities around then-presidential candidate Jair Bolsonaro, Brazilian journalist Patrícia Campos Mello's employer received hundreds of thousands of harassing WhatsApp messages and threats of physical confrontation—so much so that her employer, the newspaper Folha de S.Paulo, was forced to hire a bodyguard for her. She also had to cancel all events for a month. What both women shared was that they dared question power while being visible on social media.

It isn't just famous or highly visible women who are facing enough online abuse to consider leaving social media. A YouGov poll commissioned by the dating app Bumble showed almost half of women age 18 to 24 received unsolicited sexual images within the last year. UK MP Alex Davies-Jones put the phrase “dick pic” into the historical record during the debate on the UK Online Safety Bill, when she asked a male fellow



Gina Neff is Professor of Technology & Society at the Oxford Internet Institute and the Department of Sociology at the University of Oxford

MP if he had ever received one. It is not, as she said, a rhetorical question for most women. AI-enabled intimate image abuse that combines images to create or generate new, often realistic images—so-called deepfakes—are other weapons for online abuse that disproportionately impact women. Estimates from Sensity AI suggest between 90 to 95 percent of all online deepfake videos are non-consensual porn, and around 90 percent of those feature women. The technology to create realistic deepfakes is now outpacing our ability and efforts to combat it. The barriers to entry for creating deepfakes are so low, what we now see is a perverse democratization of the ability to cause harm.

And the effects of online harm against women are chilling. We can look to research that's been done in societies where women face more social restrictions to see the impact. In a pioneering research study, Katy Pearce and Jessica Vitak found women in Azerbaijan opting out of being online because the potential real-world repercussions resulting from online harassment were simply too high in an honor-based culture with high degrees of surveillance. In other words, women faced an impossible double standard: unable to control their image on social media, but punished severely for it.

There are answers: better safety-by-design measures can help people control their images and their messages. For example, Twitter recently allowed people to control how they are tagged in photos. Dating app Bumble rolled out the aptly named “Private Detector”, an AI-enabled tool allowing users control over which—if any—unsolicited nude images they want to see. Legislation, such as the UK's proposed Online Safety Bill, can push social media companies to address these risks. It is far from perfect, but the bill takes a systems-based approach to regulation, asking platform companies to assess the risks and develop upstream solutions such as improving human content-moderation, dealing better with complaints and pushing for better systems to take care of users.

This is not guaranteed to keep women from logging off en masse in 2023. If they do, not only will they miss the benefits of being online, our online communities will suffer.



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AN AI EYE

“I love shooting pictures of one of my passions—FOOTBALL!” says Dave Imms, who captures Premier League hopeful Andre Odeku. “As a longtime admirer of the works of Eadweard Muybridge, I knew exactly how I wanted to shoot Andre: in a series of movements acting as a record or a measure, but combining it with a lighting aesthetic alluding to the AiScout app as a robotic voyeur—the deep red tones are my homage to 90s *Terminator* chic.”

Colophon



IT’S IN THE DETAILS

“It was fun to bring these very different products together with the dark moody background,” says Sun Lee, who photographed the Gear section this issue. “One of my tricks is to partially hide some of the detail on a product, while making the rest super-crisp—it makes things more fascinating to look at, and draws in the viewer’s eye.”

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ARIE makes bioactive health products for Gen Z. As an industry pioneer, they want to become the world's first microalgae integrated farm-to-bottle for brain health. For a limited time, ARIE is issuing a Convertible Note/ Loan Note for their pilot facility. Contact cs@arieliving.com for more information.



MOI MILI

Moi Mili is a premium lifestyle brand, offering top quality lines of luxury pillows, decorations and accessories, crafted with genuine concern for the right mood at home. Klaudia Wcisło, the brand owner, loves to enliven and decorate the interior so that it gives a sense of security and uniqueness. Original Moi Mili products are available in many stationary boutiques and concept stores, as well as online stores almost all over the world. Visit moimili.com and follow [@moi_mili](https://www.instagram.com/moi_mili) on IG.



CONVOY FRAGRANCES

Innovate your fragrance game with CONVOY, makers of the most advanced solid fragrances for men. Developed in Grasse, France, these highly concentrated solid parfums are alcohol free and will travel anywhere with you in an ultra-portable and re-fillable metal case. Visit convoyuk.com and follow [@convoy_uk](https://www.instagram.com/@convoy_uk) on IG.



STEPHANIE DILLON

STEPHANIE DILLON is a Minneapolis based artist who uses salvaged and reclaimed canvases as a base for her vibrant and colourful works. Stephanie has developed a bold style while utilising many mediums: from found objects and traditional painting to digital and crypto art, she uses these tools to express her pain, joy, and grief while highlighting her profound gratitude for life. She celebrates beauty in the unexpected and helping bring that joy to others through her work and through collaborating with other artists. Her feeling is that whenever something is thrown out, she can potentially turn it into something beautiful again. Art is everywhere. Pictured is "Paper Flowers on Broken Heart", an acrylic and aerosol painting on canvas with collaged vintage elements. For more information on Stephanie and her collaborations, visit StephanieDillonArt.com or follow [@stephaniedillonart](https://www.instagram.com/@stephaniedillonart) on IG.

OTKUTYR

OTKUTYR's SS/23 Bridal Haute Couture capsule is inspired from a fairytale; depicting the feelings that a bride goes through on her monumental day. From the extremely detail oriented and regal, to the simple and body hugging silhouette for the girl next door. Special thanks to Jean Baraq lace for custom making OTKUTYR's lace design for the biggest wedding gown in the collection. 8 months of hand beading work following their visions, exact placement and design. OTKUTYR is proud to be the oldest French lace ambassadors and to view the latest collection don't hesitate to book an appointment: info@otkutyr.com. Visit otkutyr.com and follow [@otkutyrfashionhouse](https://www.instagram.com/@otkutyrfashionhouse) on IG.



KNDLZ

A handmade 100% organic line of candles to help people establish an atmosphere through scent where they can create their own inspiring ritual to balance their energy, practice aromatherapy and self-care. Use wrd25 for 25% off (ends 02/04/23). Photo by: Carolanne Lamontagne. Visit kndlzshop.com and follow [@shyckndlz](https://www.instagram.com/@shyckndlz) on IG.



WIRED
ADVERTISING
FEATURE



OAKS CLOTHING

Oaks was created by a mother who envisioned a better tomorrow for her children. Oaks' quality articles are designed to mix and match with each neutral piece having been carefully, and lovingly, designed with your children in mind. So let them be little and let them run free- they will change the world with individuality and compassion! Visit oaksdeeplyrooted.com and follow [@ohheyoaks](https://www.instagram.com/@ohheyoaks) on IG.

01/02.23

TO APPEAR HERE, CALL
020 7152 3705 OR EMAIL
CLASSWIRED@CONDENAST.CO.UK

TYPE B COLLECTION

Launched in 2020, Type B collection was founded on the principle of quality while offering exceptionally creative designs. Montreal-designed and Italian-made, Type B demonstrates the versatility of scarves. Designed to tell a story, each scarf is fabricated using hand-made materials and meticulous attention to detail. Visit typebcollection.com and follow [@typebcollection](https://www.instagram.com/typebcollection) on IG.



YAY FOR YOU

The Los Angeles based brand YAY FOR YOU is sustainably made with deadstock fabrics. Babies with good taste everywhere will want more than one! 'The New Onesie' is designed to keep up with your baby's adventures. The unisex design provides maximum mobility and flexibility in any situation. Discover more at yayforyoubaby.com and follow [@yayforyoubaby](https://www.instagram.com/yayforyoubaby) on IG.



SAMMY

SAMMY is a modern luxury athleisure and swimwear brand inspired by the vibrant, yet laidback lifestyle of Miami. Their collection of finely tailored classics is thoughtfully crafted with a blend of breathable fabrics imported from Italy, Japan and Peru. These pieces are designed with versatility in mind to invoke a feeling of ease. The brand takes a visionary approach to inclusiveness that is devoid of conventional gender essence. Shop online at sammyshop.com and follow [@sammyshop](https://www.instagram.com/sammyshop) on IG.



ANI BIOME

Upgrade your gut health performance with Ani Biome's personalised programme. Ani Biome offers a unique approach to one's microbiome by assessing a set of biological and psychological markers. Their aim is to increase vitality through understanding the baseline level of one's systemic inflammation. Members receive a monthly pack of fermented microblends infused with nutraceuticals in convenient snap packages to be diluted in a glass of water. Start your longevity journey today at anibiome.ai and follow [@ani.biome](https://www.instagram.com/ani.biome) on IG.



PHILIPP METTLER STUDIO

Created by Swiss artist PHILIPP METTLER, this 60x50 (cm) canvas paints explicit cues of a seemingly fantastic Nippon landscape through elements of abstraction. One can imagine a foreground of greenery with a clouded mount in the back; this interpretation has devised this work's name: "Hokusai's Skywave". Although interpretable this way, METTLER's creations invite every spectator to imagine their respective personal worlds: that is the power of abstraction. Find upwards of forty pieces from diverse yet intrinsically similar series on philippmettler.com, as well as on [@philippmettlerstudio](https://www.instagram.com/philippmettlerstudio) on Instagram.



MAEV

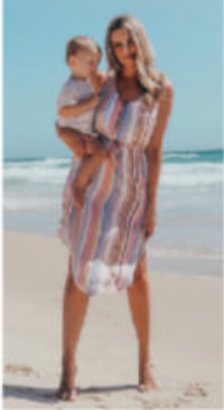
MAEV is one of the first US based human-grade raw dog food companies. Diet is the most important choice you make for a dog. Now, the healthiest choice is easy with Maev. Follow [@meetmaev](https://www.instagram.com/meetmaev) on IG or shop online at meetmaev.com.

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PHIGOLF MOBILE & HOME
GOLF SIMULATOR

Enjoy a round of golf on world famous courses from your own home with Phigolf. Be amazed as the on-screen avatar mirrors your swing motion in real-time! From beginners to pro's Phigolf is perfect for get-togethers and if you're looking for something to keep you entertained during the winter. Use Code WIRED for 10% off on mailordergolf.com (expires 01/03/23).



PEACHYMAMA

PEACHYMAMA gives mothers the freedom to breastfeed anywhere in clothes they love without exposing their belly or bust. An Australian born clothing brand, PEACHYMAMA is a maternity nursing wear specialist, offering a wide selection of new season postpartum styles designed to fit an after baby body beautifully. Visit peachymama.com.au and follow on Instagram [@peachymama.official](https://www.instagram.com/peachymama.official) on IG.

THE ASSIGNMENT: IN SIX WORDS, WRITE A STORY ABOUT AN EVIL TWIN.

BUT I WAS AN ONLY CHILD.

—Andy Walton, via Facebook



Honorable Mentions

He did what she would not.

—Eric Nisly, via Facebook

They think I'm the good one.

—@bobtheimpaler, via Instagram

"Well, only if you stay digital."

—Morten Kielland, via email

Her eye is mine for eternity.

—@cessmtz, via Twitter

"Relax. Mom will never find out."

—@ascendant_dada, via Instagram

I'm the one you really want.

—@kalkikanmani, via Twitter

Only mirrors can reveal the truth.

—@BuddhaandDog, via Twitter

Born triplets, but three's a crowd.

—@jkadz, via Instagram

Want to submit a six-word story for us to consider? At the beginning of each month, we ask for new ideas on Facebook, Twitter, Instagram, and WIRED.com/six-word, where you can also see how we've illustrated past favorites.

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